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WIRELESS TELEGRAPHY IN NAVAL MANOEUVRES.

The recent agitation concerning a system of electrical signaling, using high-frequency ether waves as its medium, and the action of the Italian Government in experimenting with this system at its dockyards, have caused many to lose sight of an older form of wireless telegraphy perhaps better applicable to the needs of communication with a naval squadron at some distance off shore.

As long ago as 1851 James Lindsay, a Scotchman, experimented with signaling through the earth or water, by setting up lines of electrical flow between two points at some distance apart. These currents made themselves manifest to apparatus of sufficient delicacy at other points more or less remote. In 1859 Lindsay actually telegraphed by this means to a distance of 2 miles, and on the strength of his experiments proposed to establish communication with this country through the agency of two stations, one in Cornwall and the other in the north of Scotland, two other stations being conveniently situated on the American coast. Experiments of much the same sort were made by French officers during the siege of Paris, but were brought to a conclusion by the establishment of peace in 1871. In 1895 a similar arrangement was successfully used in England for communication across a channel 5 miles wide. From the experience gained through this last experiment it was learned that the depth of water has much to do with the success of the signals, about 100 feet being the best depth.

Given alternating currents of considerable strength in the transmission circuit and telephones of great delicacy in the receiving circuit there is no doubt that this method of signaling could be made operative at considerable distances, and that communication could be had (in one direction) through its agency with a fleet at some point in the offing. For example, if connection were made to two points, one on the south coast of Long Island at a point perhaps 75 miles east of New York, and another on the New Jersey coast at an equal distance south of the city, the presence of an alternating current between them could be detected by telephones on ships over a large intermediate area. The equipment of the vessel would consist of a float attached by an insulated cable of considerable length —say half a mile—and towed behind the ship. The telephone would be connected to this and the hull of the ship. The method used in the synchronograph for breaking an alternating current at the instant of zero flow might be used in handling quite heavy currents, and signals of great energy thus transmitted.

The chief problem with this plan would seem to be the difficulty of getting a sufficiently large current from one terminal to the other to set up a perceptible difference of potential between the ends of the telephone circuit. If the electric resistance of the ocean were considerable it would, of course, be a simple matter to maintain a potential difference of hundreds or perhaps thousands of volts between the two line terminals without a prohibitively large expenditure of energy. This would give readily detectible electrical pressure to the receiving loop. The low resistance of salt water might, however, make it necessary to send many amperes over the land line, costing no small amount for copper and power.

SOME CHARACTERISTICS OF THE SERIES MOTOR.

The series-wound direct-current motor has come into almost universal use for traction purposes in spite of some advantages of the shunt-wound motor, notably the possibility of restoring power. Perhaps the main reason for this popularity is the fact that the series motor, so to speak, automatically adjusts its own field strength to give a suitable back E. M. F. for constant potential working over a wide range of armature speed. Thus, while the shunt motor, running across constant potential mains without resistances in its armature circuits, requires a new adjustment of its field strength for every different speed in order to give a suitable back E. M. F. and thereby avoid a serious rush of current, the series motor automatically adjusts its field exciting current and thereby its field strength, maintaining a proper balance in the circuit with a wide range of speeds. The armature distortion of the series motor is almost independent of the current flowing, as the field strength varies with the distorting tendency. On the other hand, the torque of the series motor is dependent on the speed, and without the use of power wasting resistances, the torque at any speed cannot be materially modified.

Another disadvantage of the series motor, particularly in traction work, is the arcing and flashing incident to opening the circuit. This is due to two causes, one of which does not seem to have been generally appreciated. In the first place, there is the self-inductive action of the magnetic circuit of the motor, the effect of which is well known. The field magnets when energized contain a certain amount of stored energy which must be liberated when the circuit is broken. This energy is largely spent at the point of rupture, thus liberating there a certain amount of heat which cannot be reduced no matter what precautions are taken to avoid arcing, such, for example, as quick break devices, magnetic or atmospheric blow-outs, etc. Such devices do, however, reduce the arcing, by their tendency to prevent the current, impelled by the main E. M. F. of the circuit, continuing across the contacts for a longer time than it would owing to the self-inductive action alone. The shunt motor, of course, has in its armature circuit a comparatively small self-inductance, viz., only that of the cross magnetization of the armature, involving a comparatively small amount of stored energy.

The other cause for greater arcing with series motors is the fact that the back E. M. F. of the motor dies out as the arc is drawn. To illustrate by a concrete case, the conditions of a good shunt motor of moderate size working on a 500-volt circuit may be taken. Such a motor at ordinary load exerts a back E. M. F. equal to about 95 per cent. of the impressed E. M. F. or, in the case assumed, 475 volts. When the armature circuit is opened it breaks a current of a certain number of amperes at 25 volts; in other words, the E. M. F. across the break (neglecting the self-inductive effect) immediately after the circuit is opened is only 25 volts. The effect on the circuit gap is the same as though the armature were a dead resistance, taking the same current at 25 volts. This is the case whether the main supplying the whole motor or the armature circuit alone is opened, leaving the fields excited. In the former case, the fields obtain their excitation for the moment by current supplied from the armature and only gradually die down as the armature loses speed. In the case of the series motor, however, as the contact points move apart the arc which is drawn acts to interpose a resistance in the circuit which reduces the current flowing. This immediately reduces the field excitation and consequently the back E. M. F. of the motor, and as the arc becomes longer and the current falls off, finally approaching zero value, the whole 500 volts of the circuit is impressed across the contact terminals in addition to the self-inductive E. M. F. of the whole magnetic system. In other words, but a few per cent. of the impressed E. M. F. acts across the gap opened in the circuit of a shunt-wound motor, while the gap in the circuit of a series-wound motor receives from the instant of opening an increasing percentage of the impressed E. M. F., running up to practically the whole at the instant of breaking. This is a consideration of no little importance in the design of traction controllers, in which the circuits are made and broken with great frequency.

The same principle applies also to the switches, fuses, circuit breakers, etc., used with direct-current generators running loads of various natures. A pure resistance load, such as a lamp load, gives the full E. M. F. of the system across the switch opening, while a shunt motor load gives but a small percentage of this. A circuit opening device supplying a combined lamp and shunt-motor load will feel only a few per cent. of the E. M. F., as, for a brief interval of time, the inertia of the shunt motor will keep it in action and run the motor as a dynamo, supplying the lamps for a short time after the main line switch has been opened.

POWER WASTED ON SHIPBOARD.

There appears in another column an abstract of a paper on the steam consumption of various auxiliary engines of the United States cruiser "Minneapolis," showing what has often been suspected but never absolutely proven, viz., the outrageous waste of steam and consequently of fuel in the auxiliary machinery. The direct-acting steam pump, which is so largely used on shipboard, can hardly be expected to be much more efficient than an open steam pipe. There is no possibility of any expansion whatever, the steam being taken for the whole length of the stroke. Generally, also, such pumps are run considerably throttled, and, as a rule, at a low speed, involving serious radiation and piston and valve leakage. The average engineer finds that by setting up the valve mechanism so as to get a short stroke on the pumps, he avoids the danger of pounding and gets more satisfactory working. The result is an abnormally large clearance, which is filled at every steam admission and emptied at exhaust, the steam so taken being thrown away with absolutely no more useful result than if it were blown out through the safety valve. Various pumps on the "Minneapolis" showed steam consumptions from 100 to 300 or more pounds per indicated hp hour.

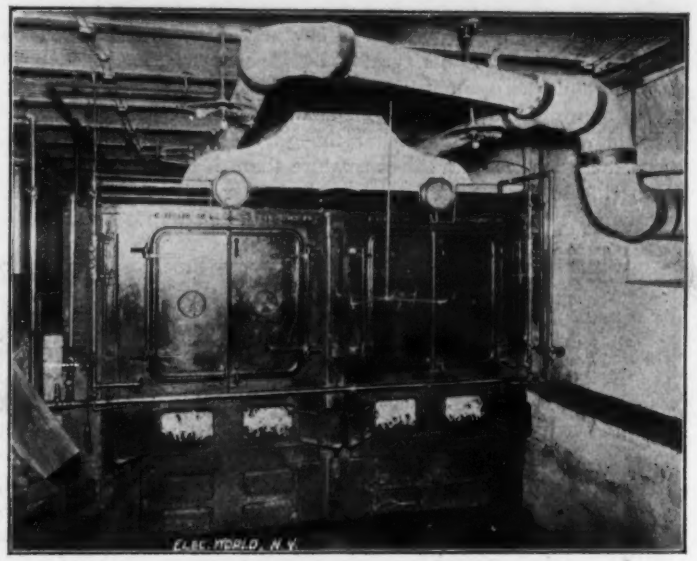
The modern ship, and especially the warship, is fitted with a multitude of auxiliary prime movers, consisting of air, circulating, bilge, fire, feed, flushing and water supply pumps, ash hoists, shop engines, lighting engines, ventilating and forced draught blowers, distilling and refrigerating apparatus, windlasses, freight and anchor handling engines, steering engines, etc., beside all the special machinery involved in the handling of turrets, guns and ammunition in the case of warships. Tests made on a transatlantic run of the "Minneapolis" indicated that over 23 per cent. of the steam generated was used by the auxiliaries.

The adaptability of the electric motor to all purposes in which power is necessary gives an opportunity for eliminating these serious losses. Electric plants for lighting purposes are necessary on all ships, and a satisfactory equipment of all the auxiliary power-consuming apparatus with motors instead of steam cylinders could undoubtedly be designed at the present day with no serious difficulty. While the steam consumption of the dynamo driving engines themselves in the case of the "Minneapolis" was rather discouraging, it must be remembered that this is a small plant compared with that required for running all the auxiliaries of such a ship and also that this plant is at present a little out of date, the use of multiple expansion engines enabling considerably higher economies to be effected. The saving in condensation alone in the labyrinth of steam pipes required for steam auxiliary engines would probably more than pay a good interest on the increased first cost of such an equipment.

The Lighting of the New York Federal Building.

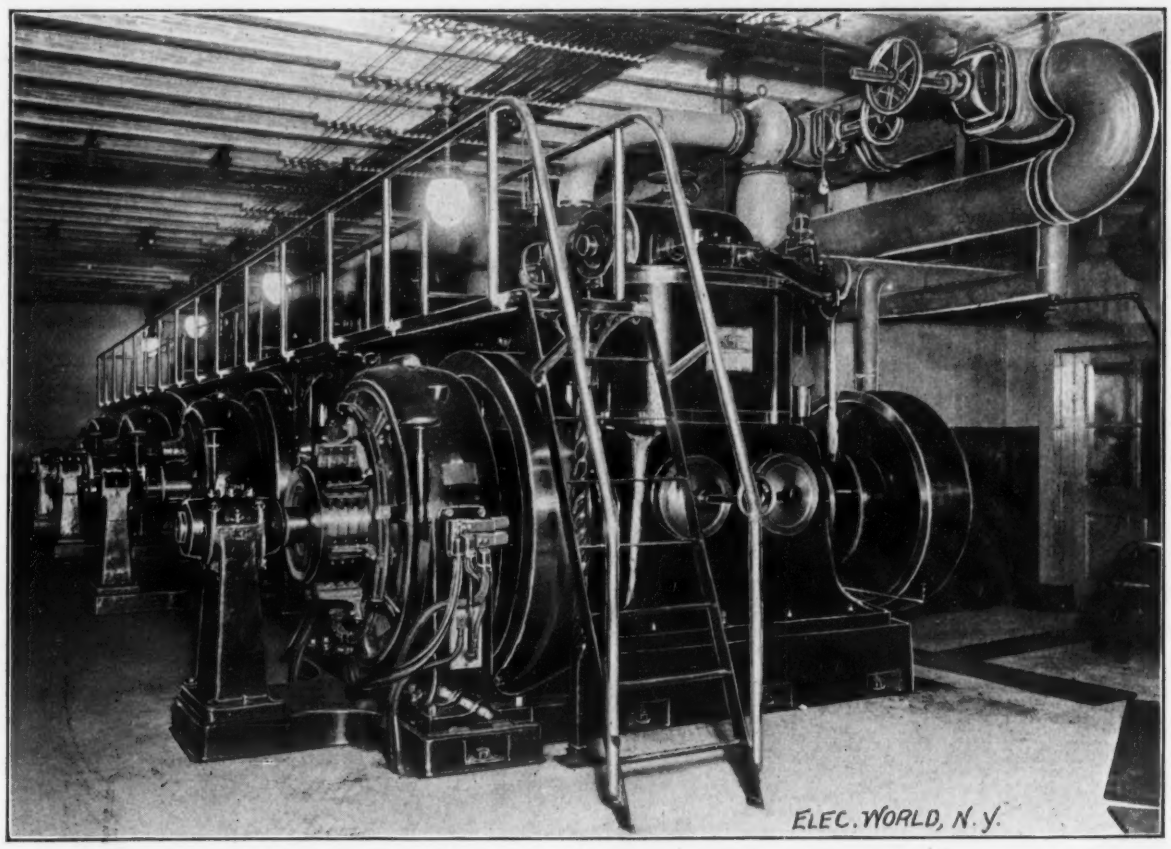
THE isolated plant lately installed in the United States custom house and post office in New York City involves no radically new principles, but is well designed in every detail, and embodies all of the well recognized up-to-date improvements. The building is a large one and considerably overcrowded with the Government departments occupying it. The enormous volume of postal traffic necessarily transacted there, owing to the commercial importance of New York City and the fact that all European mail enters the country through the port of New York, necessitates the employment of a large force of men in crowded quarters in gallery after gallery below the street level. This requires a large amount of artificial light during the day as well as during the whole night, as work in the post office never ceases, thus giving a very satisfactory load factor to the lighting plant.

Steam is supplied by a battery of ten boilers, eight of which are return tubular, 5½ feet in diameter by 18 feet in length, fitted with Hawley down draft furnaces. The boilers run with their fire doors wide open and bituminous coal is used, the New York City ordinance forbidding the use of soft coal on Manhattan Island making an exception in the case of the perfect combustion obtained in such furnaces. These boilers supply steam to the lighting engines described below and also to Corliss engines driving air compressors for the pneumatic tube mail service, to Worthington pumps for the hydraulic elevator service, and to various steam engines for freight elevators and mail hoists.



TWO OF THE BOILERS.

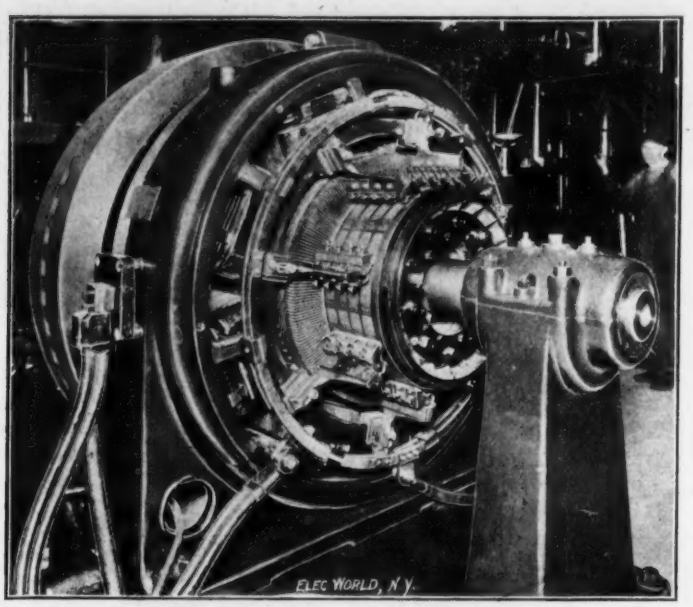
The dynamo room, about 90 x 25 feet in size, is situated under Mail Street, on the side of the building facing City Hall Square. The live steam is brought to the four main engines through two 10-inch steam pipes which come up side by side through the floor near the middle of the long room and close to the building wall. The steam mains curve away from each other and run at a height of about 8 feet above the floor to the extremities of the engine space, where they bend sharply upward through 180° and run back, meeting in the centre. Branches to the engines are taken from this upper straight main, which is fed at both ends, thus forming what might be called a ring main in a vertical plane. Valves are so placed as to cut off any section of the main, including any one engine, and every engine branch is fitted with two stop valves and a steam separator. The exhaust branches are also fitted with stop valves, the exhaust steam being used for heating purposes.



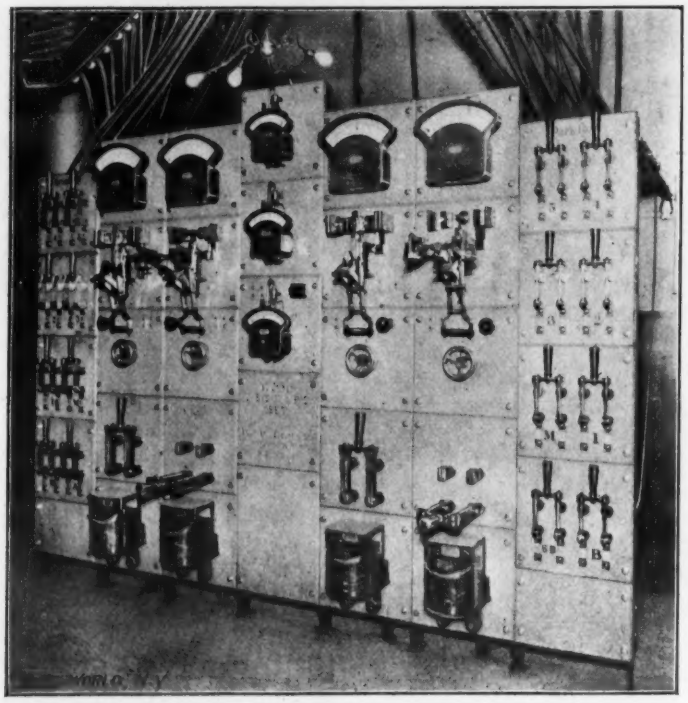
GENERAL VIEW IN ENGINE ROOM.

The four generating sets are exact duplicates and consist of Westinghouse engines, direct coupled to Westinghouse engine-type generators. Although of standard construction, a description of the salient points may be of interest. Each engine is of the vertical, two-cylinder, compound, single-acting, trunk-piston type, with a single piston valve working horizontally across the heads of the cylinders, and riven by a Rites inertia governor outside of the enclos-

ing chamber. The cylinders are 14 inches and 20 inches x 14 inch stroke, and the engines are rated at 200 horse-power each when running at 280 revolutions per minute, with a steam pressure of 120 pounds per square inch. A single cast bed plate supports both engine and dynamo. The shaft of engine and dynamo is one piece, journaled at three points, viz., the two ends of the oil enclosing chamber and one outboard bearing at the dynamo end. Overhung on the opposite end of the engine shaft from the dynamo is a heavy flywheel which serves to shelter the governor mechanism, and between the crank case and the armature there is also mounted a split flywheel, the rim of which is notched to receive a barring lever. The crank-case head on the dynamo end is also split to allow any part of the engine to be taken down without disturbing the generator.



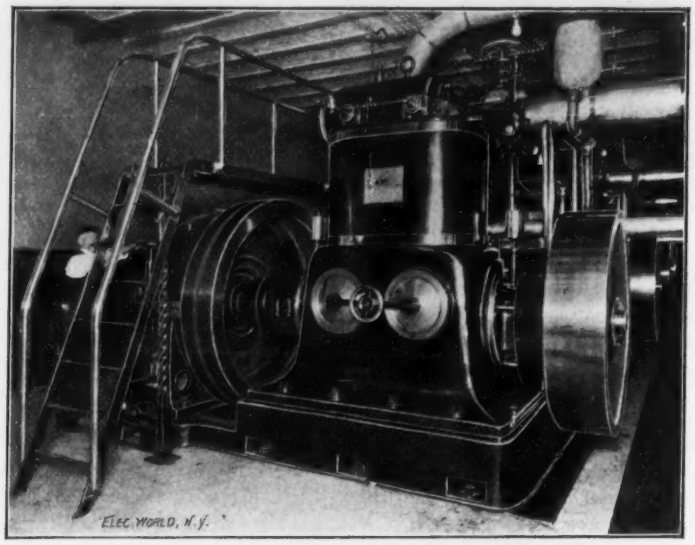
One of the Generators.



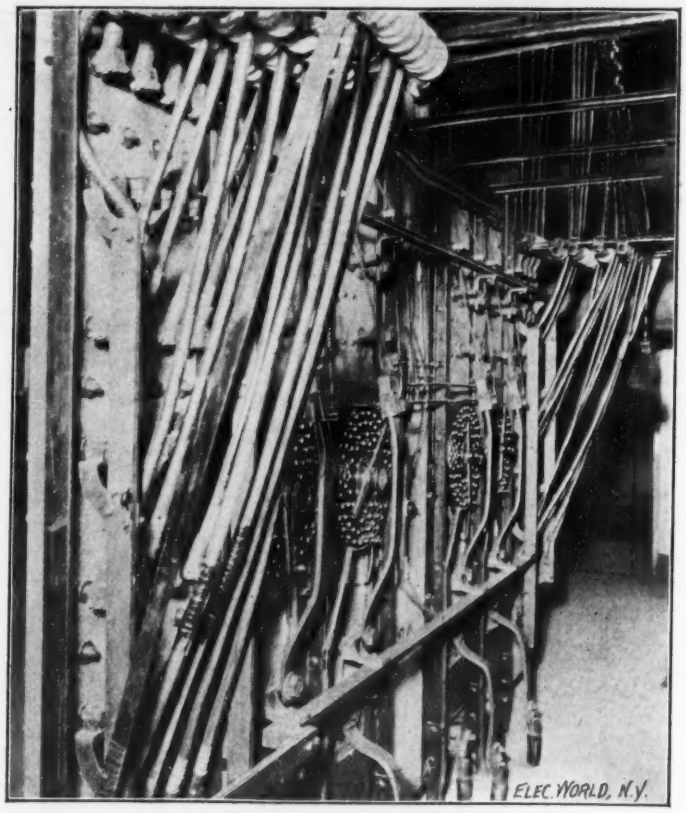
Front of Switchboard.

A noticeable feature of the installation is the engineers' gallery running over the four generators and giving a short path between the starting platforms of the engines. This gallery is built on steel I beams mounted on decorated twisted columns, and is fitted with handsome nickel-plated hand rails. A short trolley, vertically over and parallel with the shaft of each unit, is hung from the steel beams supporting the roadway overhead. On these any part of the engine or generator can be supported by a chain hoist and moved across the engine room.

Keyed to the shaft of each unit is the armature of the eight-pole 120-kw dynamo, built by the Westinghouse Electric and Manufacturing Company, capable of generating 960 amperes at 125 volts. The field cores are of laminated steel cast into the yoke and excited by compound windings, both shunt and series coils being ribbon wound. The eight sets of brushes are fixed with two copper multipling rings on a cast-iron spider held in a circular groove under a lip of the field yoke and rocked by a segment of a worm wheel engaging with a vertical worm, to the top of which is attached a handwheel. The worm and worm wheel are entirely enclosed beneath the shell of the field yoke. The whole arrangement is so shielded and covered in that it appears even more simple than it is.



One of the Engines.



Back of Switchboard.

The fields of the dynamos are split in a vertical axial plane and can be drawn apart laterally on the foundation plates for inspection or repair of the field or armature coils. Heavy screws, similar to those used in belt tighteners, allow for a fine adjustment of the field ring to bring it to a position concentric with the armature. Only the two terminal leads of the dynamos run to the switchboard, the equalizer running only from machine to machine and being fitted with single-pole equalizer switches on marble panels mounted on the yoke casting.

The switchboard is placed at the north end of the engine room and is built up of seven panels, the middle one an instrument panel, the two panels flanking it on each side being machine panels, and the two outside panels carrying the feeder switches. The board is built of a fine grade of marble cut in small plates and bolted into place on an angle iron skeleton frame. The instrument panel contains three Weston voltmeters, the lower one connected up as a ground detector, and the other two attached, one to the bus bars and the other to the voltmeter switches on the various machine panels. Each machine panel carries on its lower section a Thomson integrating wattmeter covered with a handsome glass case. Above this is the single-throw, double-pole, double-blade main switch. Still higher is the enamel field rheostat, only the handle of which appears on the front of the board, and the pilot lamp and the spring jacks of the four terminal voltmeter switch. Above these is a powerful I. T. E. circuit breaker, and at the top of the panel is the machine ammeter.

The back of the board is carefully laid out to avoid complexity. The bus bars run across the machine panels, one near the floor and one near the top of the board, and respectively turn up and down on the feeder panels, thus giving short simple connections to the switch studs. The bus bars are 2 inches by one-half inch in size. The board was built by the Southern Electric Company, Baltimore, Md, which also did all the wiring of the building. A small separate switchboard is provided with ammeter, voltmeter and main switch for the motor service, which at present is limited to the motors running the automatic stamping machines in the post office. Ventilating and other motors will probably be installed in the future.

The normal pressure of the system is 117 volts and the current is distributed to the 4700 incandescent and 37 arc lamps over sixteen feeders carried on porcelain insulators and mains run in moulding throughout the building. Thirty-seven 100-hour enclosed arc lamps made by the General Incandescent Arc Light Company are all fed by one pair of feeders on one feeder switch. The normal load of the system is about 1200 amperes, varying between 800 and 1800. The load is naturally very steady, as it is mostly in incandescent lamps, a large number of which are always in use. The whole system was designed by and installed under the direction of Chief Engineer A. B. Fry, of the United States treasury service.

The plant was started in August last, the steam for power and heating purposes and the current for lighting being purchased and supplied entirely from outside sources previous to that time. The cost of steam and current for the fiscal year ended July 1, 1897, was approximately $78,000. With the new plant, allowing 10 per cent. for depreciation, the total running cost of the installation is about $100 a day. This indicates a clear saving of $40,000 a year to the Government.

The Report of the Commissioner of Patents.

The annual report of the Commissioner of Patents for the calendar year 1897 was recently laid before Congress. It shows that in 1897 there were received 45,661 applications for patents. Patents granted amounted to 23,729. The number of patents that expired was 12,926. The total expenditure was $1,122,843; the receipts over expenditure, $252,798.

In proportion to population more patents were issued to citizens of Connecticut than to those of any other State—one to every 786 inhabitants. Next in order are Massachusetts, District of Columbia, New Jersey, Rhode Island and New York. To residents of England 706 patents were issued; to residents of Germany, 551; Canada, 286, and France, 222.

The number of applications received for examination in the year was greater than for any other in the history of the office, yet the report says there was no increase in the facilities of force for doing the work. Applications awaiting action on December 28 last numbered 11,382, due to the inadequacy of the office force.

Since 1882 155 examiners and assistant examiners have resigned voluntarily from the office. The places left vacant by these men cannot be filled at once, and their resignation is a serious loss to the Government. An increase in salaries would hold a fair proportion of them.

The influence of patented inventions is most strikingly shown in the creation of new industries of enormous magnitude since 1880—that is, within the term of patents now in force or recently expired.

The manufacture of electrical apparatus and supplies began to be of importance shortly before 1880, and in that year seventy-six establishments, employing 1,271 persons and producing an output valued at $2,655,036, were in existence. In 1890 the number of establishments had increased to 189, employing 9,485 persons, and producing an output valued at $19,114,714.

Central Station Switchboards.*

BY F. A. C. PERRINE,
PROFESSOR ELECTRICAL ENGINEERING, LELAND STANFORD, JR., UNIVERSITY.

The switchboard in a central station should be considered not only as a means of distributing electricity, but also as a central point from which influence extends which modifies the character of the work done throughout the entire plant as well as the care devoted by the workmen to the maintenance of the station.

In every plant there is some such central point of influence, which is found in the part of the machinery to which the attention of both technical and non-technical eyes is attracted. In manufacturing plants this central influential point is found in the engine room, and manufacturers so well recognize its influence that some years ago the cotton manufacturers of New England determined that 1 per cent. of the capital stock of the company expended in the equipment and proper adornment of the engine room was a profitable investment, as improving the care devoted by all the employees to the machines under their charge. The engineer and his set are the aristocrats of a manufacturing plant, and if these men take pride in the appearance of their machinery all other workmen will emulate them and the general efficiency of the plant be increased.

In a lesser degree the switchboard of a central station modifies the action of the dynamo tenders as well as the linemen and lesser employees. If poor work is done in wiring the switchboard, the circuits of the dynamo room will receive little care and those outside the station will be in a worse condition, whereas no one would be willing to have a poor piece of work exposed near a carefully arranged and well wired switchboard, and the care taken in the occasional work done on station circuits will be reflected in the results obtained on the outside circuits. In consequence of this fact the appearance of the switchboard warrants an expenditure which seems almost lavish.

In the matter of material of the board itself, choice is very limited. Solid wood boards are to-day altogether discredited on account of their easy inflammability, while skeleton ones are only to be considered as meeting the needs of the smallest and cheapest plants. The material of the board, to be fire-proof and at the same time free from possibility of leaks, brings us to the consideration of only slate, marble, glass and porcelain. Lava, or other close grained stone, might indeed be available for use, were such stones to be found regularly in the market and obtainable in satisfactory quality and sizes at a reasonable price—but at the present time these conditions are not fulfilled. Slate was at one time the favorite material for the construction of switchboards, on account of the fact that no other stone is as readily drilled and worked, nor can any other stone be found which is so cheaply obtained in large, flat slabs—but unfortunately slate is a material which is very variable in character, containing in some cases large amounts of partially reduced metallic oxides, which lower the specific resistnce of the material so far that it may become dangerous for high potential work, and in any case slate is so porous that it is not thoroughly safe to use without the European precaution of thorough impregnation with an insulating wax. This thorough impregnation is a matter of considerable difficulty, on account of the fact that the slate will frequently decrepitate on being heated to the necessary temperature, and in consequence the expense of impregnated slate is very much beyond that of the untreated material.

Porcelain is a material upon which we rely so much for insulation in difficult places that one would naturally expect to find some use of it in switchboard construction, but up to the present time no porcelain manufacturer has succeeded in making flat slabs larger than about 10 inches square, and no one has carefully undertaken the construction of a switchboard framed in metal or wood and faced with porcelain. Such a construction might indeed be a cheap and thoroughly satisfactory one, but there are still a number of difficulties to be encountered which can be undertaken only by a switchboard manufacturer. Large glass slabs would be admirably adapted to this service, but unfortunately this material is too difficult to work and in consequence the expense of a glass switchboard properly drilled for the instruments and connections would be very great indeed.

On account of the difficulties which have been met in the employment of every other material for switchboard construction, marble has come to be considered as the standard material for this service, and if the marble be obtained free from metallic veins it is entirely satisfactory. It has the advantage of a sufficient strength

*Extracts from a paper read before the San Francisco Convention of the Pacific Coast Electric Transmission Association, February 15, 1898.

to stand whatever shocks may come from throwing switches. It is not porous to any appreciable degree and it may be found in many colors, so that it is easy to obtain marble in which the instrument facings may form a sharp contrast and be readily read from all parts of the station. The relative advantages of native and European marbles involve not simply the question of beauty and evenness of texture, which are the points considered in marble carvings and statuary work, but also the question of an absolute freedom from metallic veins, which is a property of the pure white Italian marble. Furthermore, no other marble is so easily kept clean, nor is any other found with which the instruments give so sharp a contrast, and, where the expense is not prohibitory, the use of this marble is to be favored, but at the same time, should its cost be very great in comparison with that of native marbles, a careful consideration of the color of the instruments and the instrument scales should result in contrasts which would be sufficiently striking for the instruments to be easily read and manipulated.

After the material of the board itself, the switchboard circuits are the most important item in construction, and the most important question in the consideration of circuits is that of the proper character of the insulation to be employed. In this service everything should give way to fire protection, the weatherproof character of the insulation being entirely a secondary consideration. These circuits when definitely located are rarely laid flat along the surface of the board, and never touch one another, nor is there likelihood of the switchboard ever being wet with water, and in consequence any insulation which gives satisfactory protection against damage from accidental contact will be satisfactory, if at the same time it is impossible to ignite it.

While, therefore, the fireproof character of the insulation for a switchboard and for station circuits is of the first importance, it must not be forgotten that it is everywhere advisable that all parts of high potential circuits should be either well insulated or so hidden that accidental contact is impossible. More than one man has been injured at a high potential board by stumbling and trying to catch himself, consequently it is not only sufficient to place the switch points behind the board, so that the switch handles may be safely worked, but it is also necessary to protect these switch points in such a manner that rapid connections behind the board may always be performed without danger of contact with deadly circuits. This necessity was fully recognized by Mr. Ferranti in all of his high potential work, and it is to the credit of his foresight that so few accidents have occurred in plants that he has installed.

In low potential working great insulation of switchboard circuits is not necessary and hardly even advisable, but it is rather necessary that low resistance and good lines and good contacts at all junctions should be assured. Low resistance now means not only a large area of copper, but also good heat radiating surface, so that the wires may remain at their normal temperature even when carrying large amounts of current. Various experimenters have proved that a black surface will radiate heat twice as well as a white surface, and in consequence the common practice of polishing and lacquering bus bars and switches is not only an extravagance but a bad practice from an engineering standpoint.

In aiming at simplicity of design and ease of working about the switchboard the principle may be laid down as regards instruments that no more should be installed than are necessary for the manipulation of the plant and for obtaining a daily or hourly log report on its operation. This implies perhaps a few more instruments than are absolutely necessary for the manipulation of the plant. At the same time the log gives the only true data for an engineering test of plant operation. Tests under test conditions always give results more or less fictitious. Every man is, as the saying goes, at "test pitch." He desires to show his maximum efficiency, and the maximum efficiency of the machines with which he is working, and in consequence the occasional test of a plant will give results better than those obtained from actual service. On the contrary, the log gives a report by means of which may be detected those little leaks which eat into the profits and which indicate a falling off in the efficiency of either men or machines.

Whatever instruments may be installed their arrangement is of the greatest importance, but if the general criterion be applied to all switchboard designs that all switches and rheostat handles and other apparatus of manipulation be placed at convenient levels for handling and that all related instruments be grouped so that they may be easily observed the best results will be obtained. These ideas are so obvious that it may seem strange to bring them forward, but it is even stranger to find that they are so often disregarded. Large and expensive boards are often found where the same man cannot at once manipulate a machine rheostat and observe the effect he is producing upon the instruments. Not only may rheostats be operated through the medium of a sprocket wheel and chain, but also it is possible and not necessarily expensive to locate switches at a distance from the operating handles, and if these points be taken into consideration the excuse for inconvenient location of related apparatus disappears. A worse practice than this, however, consists in the placing of fuses, circuit breakers and switches likely to flash, at points where they become elements of positive danger to the operators or to the circuits. Here again it is necessary to insist on the fact that the switchboard must often be rapidly manipulated and the service saved at the risk of some personal danger, which cannot be encountered with fuses and circuit breakers and switches flashing in the workman's face, and sending up arcs which burn off his circuits. This question of the separation of instruments and the handles by which they are worked reduces some of the difficulties of switchboard location and some of the dangers connected with high potential working, for by these means it is not only possible to install a safe board which can be placed far away from a wall by placing the switches to the rear of the board and the handles in front, but it also allows the location of all apparatus vertically above the manipulating handles, and at the same time, on the face of a tall board placed up against a wall. If this is done, however, the board must be tall enough to allow a gallery for the manipulation of circuits, and the old custom of making circuit changes from ladders should not be contemplated.

Finally the question of the proper location of a switchboard is perhaps the most perplexing of all the points in the station design. The board may be placed anywhere, and for this reason there is a certain temptation to disregard its location in the original plan of the station, but if it is to be considered as a centre of influence, and if it is to be considered as a point at which rapid changes can be made which will certainly preserve the service in spite of accidents to lines or machines, it must be placed prominently, and so prominently that all work about it may be easily seen, as well as so prominently that the station attendants may watch it for their guidance. The board should then be clearly lighted, the space about it on all sides should be sufficient for careful and rapid work, but above all it must be carefully surrounded by a space insulated from the ground. The fact that the switchboard is set on edge and towers into the air does not warrant the assumption that it does not need a clear floor space about it. Neglect of this consideration has often resulted in unreliable service, which transmission plants cannot contemplate. With the introduction of long distance power transmission the time has passed for the occasional temporary interruption of service, and until machines and lines may be built which will never fail, the switchboard will remain the one point from which it is possible in almost all events to maintain absolute continuity of service.

A Dry Storage Battery.

A portable electric lamp for miners, fed by a peculiar form of storage battery, was described in a paper read by G. Nicôlai at the Mining School of Liege, Belgium. The storage battery, known as the Sussman accumulator, uses in place of a liquid electrolyte a paste of filter paper reduced to a dry powder, or cellulose formed into a plastic mass. This is saturated with sulphuric acid and filled in between the plates, which are covered with a layer of lead oxide formed into a paste with a weak solution of india rubber and sulphate of ammonia.

Meeting of the American Institute of Electrical Engineers.

The regular meeting of the American Institute of Electrical Engineers was held in New York City on Wednesday, March 23. A paper was presented on the subject "Insulation and Conduction," by Prof. Reginald A. Fessenden, of the Western University of Pennsylvania.

Power Transmission Plants in Mexico.

A polyphase transmission plant of 1000 horse-power will shortly be put in service in San Ildefonso, 20 miles from the City of Mexico. Another plant of 2000 horse-power is to be located in Rincon Grande, near Orizaba, for use in a large cotton mill.

Steam Consumption of the Auxiliary Apparatus of the U. S. S. "Minneapolis."*

The apparatus for testing the auxiliaries was primarily arranged to find the steam consumption of the dynamo engines. From an inspection of the cylinders it was known that these engines used an abnormally large amount of steam, due to leakage past the pistons which were grooved for water packing, and were without packing rings. New pistons with snap rings were designed and fitted in the cylinders of one of the three dynamo engines, and tests were made to ascertain whether the saving was sufficient to warrant the change in the remaining two. The method adopted in all experiments was to measure volumetrically the condensed exhaust steam in barrels provided for that purpose, the temperature being observed and the weight of the water derived from these observations and sample weighings. No attempt was made to specially prepare any auxiliary for testing. All were periodically examined and repaired, as found necessary, and thus kept in good condition. The tests were made as opportunity offered and with the auxiliary doing the service work required aboard ship. Indicator cards were taken during the different tests.

The electric lighting plant consists of three 24-kw generating sets constructed by the General Electric Company, Schenectady, N. Y. Each dynamo, which is compound wound of the multipolar type, is driven by a two-cylinder, simple vertical inverted engine, the crank shaft being coupled direct to the armature shaft, and the bed plate common to both engine and dynamo. The designed speed of each engine is 400 revolutions with 80 pounds of steam pressure, the maximum output being 300 amperes at 80 volts. There is, however, considerable reserve allowed for in the design, and the engines are capable of a much higher power than that necessary to produce the output mentioned.

The engine cranks are set at an angle of 180°, and one eccentric, working through a rock shaft, furnishes motion to drive both valves, one for each cylinder. These valves are of the piston type without packing rings, one supplying steam at its ends, and the other in the middle. An automatic shaft governor regulates the angular advance of the eccentric, and tends to keep the speed constant with a variable load.

The valves are placed on the fronts of the cylinders, and the valve chests and cylinders are in one casting. The pistons, which are intended to be a neat fit to the cylinders, have three circumferential grooves for water packing. An examination of the cylinders, pistons and valves, preliminary to testing, showed the following results:

No. 1 Dynamo.—Both cylinders considerably eroded near middle of stroke, for about one-half the circumference, due to constant blowing of steam past the pistons; pistons a bad fit to cylinder bores. Forward valve a loose fit, after one fairly tight.

No. 2 Dynamo.—Cylinders slightly pitted and rusty, except about one-third of the circumference; pistons a closer fit than No. 1, but steam evidently blows past both pistons. Forward valves a fair fit, after loose and leaks.

No. 3 Dynamo.—Cylinders in fair condition and pistons a good working fit. Forward valve loose and top bridge piece between ports rusty from leakage of steam; after valve a fairly good fit.

As before mentioned, one new set of pistons with spring rings was cast, and these substituted at different times for the water-packed pistons in all three dynamo engines. To determine what saving resulted, a test was made of each engine before and after the change.

All tests were made with the dynamos doing the ordinary lighting of the ship. Usually one dynamo was sufficient for this, and in the absence of any special reason it was the rule to change from one to another in regular order every twelve hours.

A reducing valve and a separator are located in the dynamo room; the piping is so arranged that steam, before its admission to the cylinders of any of the engines in use, passes through both.

Tests made on No. 1 engine with and without new pistons and spring packing rings showed an average steam consumption per indicated hp hour with water-packed pistons of 123 pounds, and with pistons fitted with spring rings of 69 pounds, the loads varying from one-half to full load and averaging about two-thirds loads in each case. This great difference in the steam consumption would amount in a 24-hour run at this load to over 16,000 pounds of steam, or, assuming a boiler efficiency of 1 pound of coal per 7.75 pounds of water, the difference in coal consumption would be over 2000 pounds. Tests on one of the other dynamo engines fitted with pistons grooved for water packing showed an average steam consumption per indicated hp-hour of 109 pounds, with the dynamo loaded to about half its rated load, and 84 pounds per indicated hp hour with the dynamo loaded to about 15 per cent. overload. The same engine fitted with new pistons with spring rings showed steam consumptions of 65 pounds per indicated hp hour, on tests made at slightly over half load. The saving on the third engine was also considerable, although not as great as on the other two. Unfortunately, the steam consumption per electrical horse-power output was not derived, as the instruments for measuring the output were not sufficiently accurate.

While these steam consumptions seem to be considerably greater than they should be, the steam consumption of some of the other auxiliaries was still more serious.

The following table shows the indicated horse-power and steam per indicated horse-power of some of these auxiliaries:

Name of Auxiliary.	I.H.P.	Steam per I.H.P. Lbs.
Pump of starboard condenser	1.23	266
Circulating pump engine (fly wheel)	19	55
Starboard air pump	6.5	183
Centre air pump	25	78
Vertical duplex fire pump	1	205
Horizontal duplex fire pump	0.8	319
Same pump	6.4	156
Vertical duplex bilge pump	2.5	171
Fire room feed pump (vertical duplex)	8.8	91
Same pump	1.6	243
Forced draft blower engine (fly wheel)	16	77
Single cylinder horizontal flushing pump	1.4	194
Air ice machine	6	70

Tests made of the relative amounts of steam consumed by the main and all the auxiliary engines on a run made between Gibraltar and League Island, Pa., showed that the main engines used about 33,600 pounds of steam per hour and all the auxiliaries about 10,000 pounds per hour. In other words, over 23 per cent. of the steam generated was required by the auxiliary engines.

* Abstracted from a paper by Past Assistant Engineer W. W. White, read before the American Society of Naval Engineers.

A Method of Calibrating Ammeters or Electrodynamometers.

BY H. S. CARHART,
PROFESSOR OF PHYSICS AT THE UNIVERSITY OF MICHIGAN.

The following method of obtaining large alternating currents for calibrating ammeters and electrodynamometers is so obvious when described that one can scarcely believe it to be novel. Still I have never seen it described, and it may be new to some at least.

The particular advantage of the method lies in the fact that it requires only a small amount of power and no lamp load, non-inductive resistance, etc. It assumes that one has available a standard instrument for the measurement of alternating currents, such as a Kelvin balance of the requisite capacity. A source of low E. M. F. and small output is all that is necessary in addition to an ordinary transformer. I use a small alternator capable of giving a voltage up to 135 volts. Connect this directly to the primary of the transformer, whose secondary must have a current capacity equal to the maximum current of the instrument to be calibrated. Then connect in series the standard instrument and the one to be calibrated, so as to short circuit the secondary of the transformer through them, using short, stout wires for making the connections. It will now be possible to obtain any current up to the maximum by adjusting the voltage of the small generator by varying its field excitation, beginning with low values. Since the only resistance in the secondary circuit is that of the instruments and of the secondary itself, the power absorbed is very small.

This method was suggested by a similar procedure in the measurement of the magnetic leakage or cross flux in a transformer, which consists in observing the primary voltage required to give the full load current in the short circuited secondary. It works admirably and only low voltages are employed.

When no small generator giving a lamp voltage direct is available the secondary potential difference of another transformer may be applied to the primary of the transformer employed for calibrating purposes, with an adjustable resistance in series between the two step-down transformers.

One Effect of Magnetization on Iron.

While as a rule an iron bar lengthens when magnetized, when very powerfully magnetized it shortens again.

The Temperature Coefficient of the Thomson Recording Wattmeter.

BY W. L. HOOPER,
PROFESSOR OF ELECTRICAL ENGINEERING, TUFTS COLLEGE.

As an officer in an electric light company using some hundreds of Thomson recording wattmeters, it was with something akin to consternation that I read the account in The Electrical World last September of G. W. Donald Ricks' investigation on "The Variation of the Constants of Electricity Supply Meters with Temperature and Current."

The temperature coefficient obtained by Mr. Ricks for the Thomson meter was —0.0032 in centigrade degrees; in other words, an increase of 3° C., or a little over 5° Fahr., would lower the constant 1 per cent.; while, supposing the meter to have been calibrated at 70° Fahr., a drop in temperature to the freezing point would increase the constant nearly 7 per cent.

With a meter known to possess so variable a constant as the Thomson meter tested by Mr. Ricks the complaints of customers would doubtless be even more frequent and emphatic than they now are, and the temptation for the customer to pack his meter in ice would certainly be strong.

In view of these facts it seemed to me important that the temperature coefficient of the American built meter should be carefully determined.

The General Electric Company kindly allowed my representative to select from their stock room four meters boxed ready for shipment, and these meters were forwarded to me by express on the same day.

They were of the following capacities:

No. 141,004	15 amperes	50 volts.
" 140,772	15 "	100 "
" 138,698	25 "	50 "
" 137,971	25 "	100 "

The oven for maintaining the meters at various constant temperatures was of copper, and built exactly like a chemical drying oven, except that the door was of double glass, with a 1-inch air space between the two plates. In inside dimensions the oven was 30 inches long, 20 inches high and 14 inches deep. The outer and inner walls were separated by a 2-inch space, and were strongly braced. The space between the two walls was filled with water, about ten pails being required. The oven was heated by a Bunsen burner, and during the day, when the gas pressure was fairly constant, the fluctuations of temperature were usually within 1 degree centigrade. A storage battery was employed as a source of electrical energy, and the armature and field coils of the meters were connected to separate circuits, as is usual in testing and calibrating these instruments. A Weston voltmeter and ammeter were employed, both of which were carefully calibrated with Kelvin balances. It may be of interest to note that the corrected voltmeter reading differed by only one-tenth per cent. from that of a new Weston alternating current voltmeter.

The record of the wattmeter was, of course, taken by directly observing the rotations of the copper disc. This was done in the following manner: An observer stationed in front of the oven noted through the double glass door the passage of a chalk mark upon the copper disc past the line between the observer's eye and the shaft of the meter. At the exact instant of passage, or, if the speed was high, at the exact instant of every second or third passage, the observer struck a blow upon a box, making an audible signal. After a little practice, one with a good ear for time will always indicate a passage of the chalk mark to within one-tenth of a second, unless the speed of the disc is very slow. Other observers in the neighborhood at each audible signal recorded the reading of the second hand of their watches for an interval of several minutes. Each observer then took the mean of his first and also of his last seven readings, and substituted these means for the fourth readings from the beginning and end of the series respectively. These mean readings were then taken as the true times of the beginning and end of the series of observations, and the interval of time between them was divided by the number of rotations of the disc to give the time of one rotation.

The object of writing down the actual readings of the second hand in the middle of the series is, of course, to make sure of the count. Provided the first and last seven readings are carefully taken, several readings in the middle of the series would need to be consecutively omitted to cause the result to be in doubt.

In a representative observation the mean results obtained by the different observers were 1.366, 1.364, 1.363 and 1.367 seconds.

With each meter a set of observations at various loads, but constant voltage, were taken in the neighborhood, respectively of 0°, 16°, 32° and 42° centigrade.

The following is a table showing the mean value of the temperature coefficients observed for the various meters for the indicated ranges of temperature:

Capacity and Number of Meter.	Range of Temperature in Degrees, Centigrade.	Mean Value of the Calculated Temperature Coefficient.
(25—50) No. 138,698	0—44	—.00056
	0—33	—.00031
	0—16	—.00059
(15—50) No. 141,004	0—63	—.00043
	0—42	—.00048
	0—33	—.00038
	0—16	—.00030
(25—100) No. 137,971	0—44	—.00050
	0—32	—.00060
	0—19	—.00053
(15—100) No. 140,772	0—44	—.00060
		Average, —.00048

It will be observed that the various values of the temperature coefficients differ considerably among themselves; the largest value being exactly twice as large as the smallest. This I believe is to be accounted for in view of the following facts:

The coefficient itself is a very small quantity, and small errors in the determination of the constant are likely to produce a large percentage change in the value of the coefficient.

For instance, meter No. 141,004 had a mean constant of .496 at 0° C. and a mean constant of .4912 at 16° C.: the temperature coefficient was therefore $\frac{.496-.4912}{16} = .00030$. Now, had the values of the constants at these two temperatures been found to be .4984 and .4888, neither of which varies a half of 1 per cent. from the values actually obtained, the resultant coefficient would have been $\frac{.4984-.4888}{16} = .000605$, or twice the value above given.

It would seem from my tests that the temperature coefficient per centigrade degree of the Thomson recording wattmeter, as manufactured in this country, does not widely differ from —.0005; that is, for each degree rise of temperature the constant of the instrument decreases about one-twentieth of 1 per cent.

Assuming that meters are calibrated at a temperature of about 20° C., it is unlikely then that errors exceeding 1 per cent. will ordinarily occur through variation of temperature.

It may be of interest to examine the manner in which the constant of the meter is affected by changes in temperature.

In the first place, the damping magnets are weakened by increase of temperature, though in the very perfectly aged magnets of the Thomson meter these changes in strength are small and cyclic. It follows therefore that increasing the temperature of the magnets lowers the drag, causes the meter to run faster, and therefore decreases the value of the constant.

In like manner increasing the temperature of the copper disc increases its specific resistance, and therefore diminishes the volume of the induced eddy currents, thus diminishing the drag and causing the meter to run faster and have a lower constant.

On the other hand increasing the temperature of the armature circuit increases its resistance, causes less current to flow through the armature, thus decreasing its torque, and therefore causes the meter to run slower and have a higher constant.

It appears from my experiments that the increase of resistance of the armature circuit is nearly but not quite large enough to neutralize the effect of temperature upon the disc and magnet. If now a meter were constructed with german silver instead of copper resistance in series with the armature we would expect much less perfect compensation, and therefore a much larger temperature coefficient, and it would still, of course, be negative.

This is what Ricks found; and therefore I conclude that the Thomson meter tested by him had german silver resistance in series with the armature. If my conclusion is correct this was certainly poor design. Indeed, were extreme accuracy demanded it would seem entirely feasible to reduce the temperature coefficient of the meter to zero by constructing the *disc* of some alloy which, while highly conducting, would have a lower temperature coefficient.

It is my intention to continue the study of the Thomson meter. Meanwhile, I wish to express my obligations to several of my students, but particularly to R. T. Wells, of the senior class in electrical engineering, for valuable assistance in the work already done.

A Constant Current Acceleration Controller.

In an article on "Electricity as a Motive Power on Elevated Railways," published in THE ELECTRICAL WORLD, August 7, 1897, Prof. S. H. Short referred to a controller of his own design, called the maximum constant current acceleration controller. The function of this controller was to provide a constant current through each of the motors propelling a car or train, of such a strength as to just avoid slipping the wheels during the time of acceleration, the current to be reduced as soon as the train reached full speed to a value sufficient to maintain it at that speed. The advantages of such a method of control, both in point of saving of time and of power, are obvious. The mechanism for automatically attaining this end is described in patents Nos. 599,804, 599,805 and 599,806, issued March 1, 1898, the three patents covering virtually the same apparatus and differing only in the wording of the claims.

In the diagrams of speed and time, Fig. 1, there are shown the rounded acceleration curve of any motor-driven vehicle with ordinary control, and the more nearly ideal sharp-cornered acceleration curve which the new controller is designed to give. In general principle the new method of control introduces no novelties, the motors being series machines of the ordinary traction variety, and the current being controlled solely by variable resistances and variations of the back E. M. F. obtained by commutating the series fields. A considerable field commutation being depended upon requires that the motor shall be constructed with ample magnetic cross section, so that the field will not approach saturation under ordinary running and will, therefore, have considerable margin for slow speed running with all the coils in circuit. The same consideration requires also that the motor shall be made with a greater margin of available

FIG. 1.—ACCELERATION CURVES.

power, or, in other words, of greater weight for the same service, than motors working with ordinary control, in order that the armature reaction shall not too greatly distort the field with a reduced number of field turns.

As applied to a single motor, the general plan of the system is

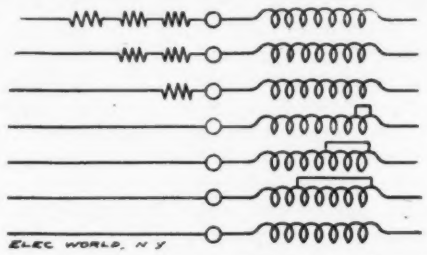


FIG. 3.—CONNECTIONS ON SUCCESSIVE NOTCHES.

shown in Fig. 2, representing a development of the controller cylinder, the contacts bearing thereon being shown in a vertical row connected to their proper points in the circuit. Fig. 3 also shows the changes in the circuit effected on the seven different notches of the controller. The connections on the first notch are shown in the upper line of Fig. 3, the current entering through three sections of dead resistance shown to the left, through the armature, thence through all the field coils in series to ground. On the next step one of these resistances is cut out. The next step cuts out another. The fourth step cuts out the whole of the resistance and also short circuits one section of the field magnet windings. These two operations might better have been made in two successive steps. The next step cuts out still more of the series windings, the sixth step still more, and in the seventh step all the windings are thrown in series again. If the controller is carried over these seven notches as the car gains speed, the resistance to the flow of the current will be reduced step by step to compensate for the increasing back E. M. F., first by cutting out dead resistance and afterward by reducing the magnetizing effect of the current on the motor field. In this way a more or less intense constant power consumption will be maintained until the last step is reached, when it is assumed that the car has arrived at maximum speed, and all the series field coils are inserted to cut down the current and thereby the torque for the maintenance of that speed instead of further acceleration.

The devices described in the patents provide for the movement of the controller by automatic means, after it has been started one notch by the motorman, in such a manner that the controller will automatically maintain a nearly constant accelerating current, thus eliminating the wide range of current strength and torque existing with careless manual control. The controller segments for the case shown are divided into two independent groups, the upper one affecting only the field magnet windings, and the lower cutting out the series resistances. The first step of the controller advances these segments as shown in the diagram to the left, throwing the ends of the bars *E* and *I* into contact with the controller fingers 5 and 9, and thereby establishing a circuit from the trolley wire, as indicated, through all the field windings of the motor, thence through the armature, thence through the three resistances, through finger 5, contact *E*, contact *I*, finger 9, and the auxiliary apparatus to ground.

This auxiliary apparatus, as shown roughly in the illustration, consists of a ratchet *R*, attached to the controller and driven by a pawl *P*, connected to the core of the solenoid *S*. The main current is led through this solenoid, which is shunted by the contacts of a relay *T*, through the winding of which the current passes to ground. This relay is adjusted so that when the current through it rises to any amount greater than the constant current wanted in the motor its armature is drawn down, thereby short circuiting the solenoid *S*, allowing the spring to retract the pawl *P*, over one tooth of the ratchet *R*. If, now, the motor speeds up and thereby cuts down the flow of current to a value less than that desired for acceleration purposes the armature of relay *T* lifts, opening the shunt of the solenoid *S*, which advances the pawl *P* and the ratchet *R* one tooth, thereby advancing the controller cylinder one notch. The first such advance brings the segment *F* in connection with the contact 6, thereby short circuiting the resistance between 5 and 6, increasing

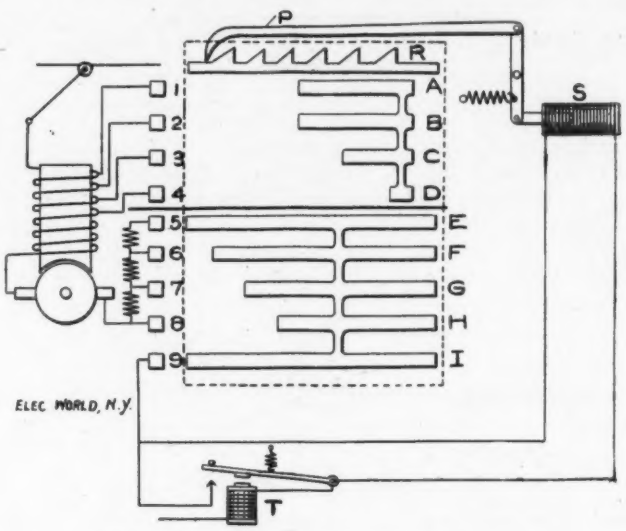


FIG. 2.—DIAGRAM OF CONTROLLER CIRCUITS.

the current through the circuit; which in turn pulls down the armature of the relay *T*, short circuits the solenoid *S* and allows the spring to retract the pawl *P*. As the motor speeds up still further the same operation of the relay and solenoid is repeated, thereby moving the controller another notch, putting the segment *G* in connection with the contact 7 and short circuiting another section of the resistance. The next step similarly short circuits the third section of the resistance, the following steps cutting down the field magnet windings by means of segments *A*, *B*, *C* and *D* and contacts 1, 2, 3 and 4. When a car has gained its full rated speed the last step of the ratchet throws the segments *A*, *B*, *C* and *D* clear of contacts 1, 2, 3 and 4, thereby inserting again all the field turns.

The same principle is applicable, of course, to the series-multiple control of two or more motors, and is so described in the patent specifications, the steps of the ratchet being greater in number and the complexity of the connections being somewhat greater than in the single motor controller. The double step to advance the motors from the series to the multiple combination is effected with the aid of the motorman, and the solenoid and relay are necessarily wound in such a way that the current from only one motor passes through them, otherwise when the motors are in series they would tend to give the car twice as great a torque as when in shunt.

The whole arrangement obviously provides a means for removing from the control of the motors the personal element of the motorman, his duty in the matter of accelerating the train consisting simply

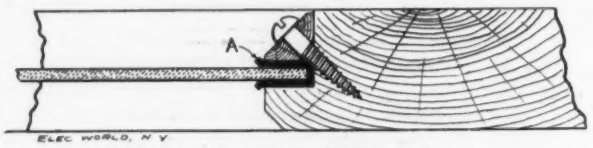
in setting the controller on the first notch, after which it automatically acts to accelerate the train with a certain given power consumption, the motorman being, of course, able at any time to instantly disengage the automatic apparatus and cut the power off. This acceleration, with constant power consumption, of course, gives constant acceleration so long and only so long as the load is constant. The greater the weight to be accelerated the less the acceleration, the two being inversely proportional to each other, and the acceleration being also varied by such factors as grades, etc. The patents state that the device is particularly designed for use on elevated roads and such service where frequent starts and stops are required, but it is obvious that this factor of variable load might introduce some serious difficulties in this service. If the controller were so adjusted as to accelerate a single car starting on a down grade at a reasonable rate, it is conceivable and very probable that the same adjustment would not accelerate a heavily loaded train on an up grade at all, the current on the first step remaining at a value too great to permit the relay to open because of the heavy drag on the motor. As the apparatus obviously maintains a practically constant current consumption which, at least during the first few steps, maintains a constant torque entirely independent of the load, the constant effort at the wheel rim will obviously start light cars a great deal more rapidly than it will heavy ones.

While the purpose of the invention, as mentioned above, is to maintain a constant torque until the car has reached its full rated speed, it is difficult to see how this is the case when the contacts operate to reduce the number of turns in the field coils, as the reduction in number of turns with the same current, of course, reduces the torque, unless the field is practically saturated with the lower number of turns, which condition would render the reduction of the field turns useless for the purpose intended.

Some Handy Devices Used on the Brooklyn Heights Electric Railroad.

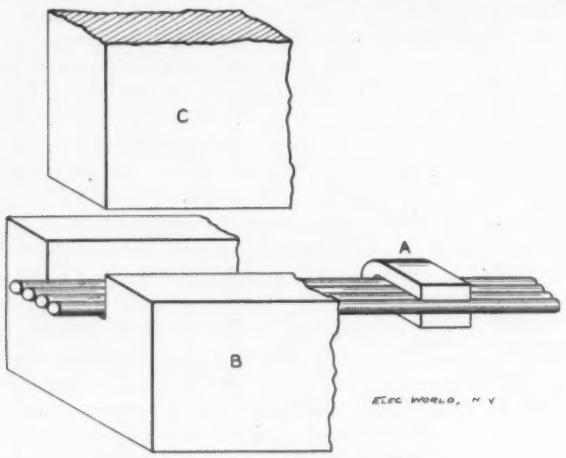
BY JAMES F. HOBART.

Overhauling closed cars in winter is something unusual in street railway car shops, but the inauguration of the trolley car service across the Brooklyn Bridge has involved considerable of this work in the shops of the Brooklyn Heights Railroad. None of the old-time cars will be permitted to cross the bridge, the dark funereal colored cars now being repainted in the Fifty-second Street shops with the new standard colors (crimson lake body with light trimmings),



An Anti-Rattling Window Sash.

several other changes being made at the same time. Among these is an interesting detail for the prevention of rattling of the glass in the window sashes. The edges of the glass plate are bedded in thin rubber sheeting which is held in place by wooden strips of triangular cross section screwed into place, as shown in the accompanying diagram. In the case of some cars recently overhauled, the specially

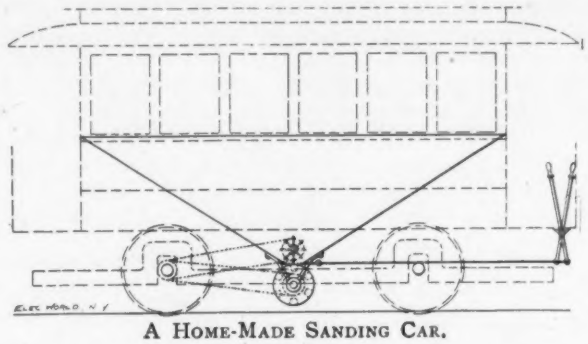


A Mould for Armature Coils.

prepared rubber for this purpose not being at hand, ordinary insulating tape was used and applied with satisfactory results.

An ingenious device for the quick firing of armature coils is used in the armature room when the necessity arises for rush work, which frequently occurs in a railroad shop. The coils are wound in the usual manner and before removal from the winding mould a number of copper clips, as shown in the diagram, are slipped over the four wires forming the coil. The straight part of the coil is then painted with rather thick shellac, immediately held in the flame of a gasoline torch which ignites and burns out the alcohol, leaving the shellac melted and very sticky. The coil is then immediately removed to a simple foot power press, fitted with heavy cast iron mould and plunger, suitably shaped for straightening out the coil. When pressed down in this the soft shellac is rapidly cooled and in about twenty seconds is hardened sufficiently to hold the coil stiff and solid when removed. A man can press in this way about three coils per minute and another man just about manage to wind and fire the same number in the same time.

The same company has recently finished and placed in operation a home made sand car, which seems to possess considerable merit in the way of simplicity, cheapness and ease of operation. The car, which is an ordinary closed passenger car, has been stripped of its seats and fitted with two hoppers, separated by a partition wall running fore and aft through the middle of the car. The lowest points



A Home-Made Sanding Car.

of these hoppers are respectively over the two rails, midway between the leading and following wheels. The hopper flares up to the level of the window sills, giving a steep slope to the middle portions of the hopper and a lower gradient to the floors running out to the ends of the car, but still sufficient when combined with the tilting of the vehicle to carry sand, even when wet, to the hoppers as fast as needed by the distributers. At the lowest point of the hoppers is a slide which can be operated by the motorman on either platform, and a small shaft running across the car with short radial arms working in the sand at the neck of the hoppers. The shaft is driven slowly by a sprocket chain from the main wheels. Directly underneath the slide of each hopper is a cast iron wheel with several pockets cast in the rim. This wheel is also revolved slowly by gearing from the main wheel axles, and its rim runs in contact with the tip of the hopper, so that as each pocket passes the latter it is filled with sand, but no running stream is allowed to escape. The sand pockets are about 2 inches square and 1 inch deep, and eight or ten are spaced about the circumference of the wheel. As the wheel revolves, these pockets take and pass the sand from the hoppers to the track at a rate exactly proportional to the speed of the car, so that sand is not wasted when the car is running slowly or stinted at high speeds. The wheel also cuts off the supply when the car stops. When on the road the motorman has only to manipulate his handle to deliver sand on either or both rails as desired, something to be appreciated in rounding curves.

A Novel Construction of Steam Pipes.

"The American Manufacturer and Iron World" states that British manufacturers have lately been making steam connecting pipes of a thin sheet copper, tightly wound with steel wire, with the interstices between the wire and copper filled by electro-deposition. It is not stated how the difficulty of obtaining a circulation of the electrolyte under the wire winding is overcome, nor how the strains due to the difference between the coefficients of thermal expansion of iron and copper are taken up.

Electric Lighting within the Arctic Circle.

According to the London *Electrician*, two towns, Hammerfest and Tromso, within the Arctic circle, have electric light plants. These plants must have a very satisfactory power factor during the long nights of the winter season.

Enclosed Arc Lamps for Series Circuits.

BY J. H. HALLBERG.

Since the invention and perfection of the enclosed arc lamp it has become possible to build a lamp of this type for constant current working, and the writer, after personally handling nearly 100 of them for street lighting purposes during the past ten months, has come to the conclusion that it is the most satisfactory and convenient street lamp, as it possesses a higher efficiency than any other type of enclosed lamp, owing to the absence of the steadying resistance.

The light from the high tension enclosed series arc lamp possesses all the advantages that are so noticeable in the low tension D. C. enclosed lamp, which are: A perfectly steady light, with perfect diffusion and distribution, the tint of which can be governed by the use of different globes. It burns from 100 to 150 hours with one 12 by ½ solid carbon. This not only saves labor in trimming and attention, but the lamp mechanism and clutch does not wear rapidly, as the lamp feeds only a few times every twelve hours. It must also be remembered that the clutch may be made to work on the soft carbon, which reduces the wear, and as there are no carbon rods the repairs on an enclosed arc lamp are only about 10 per cent. of those of an open arc. The following question is of vital importance in the adoption of such lamps: How do these lamps compare with open arcs in regard to amperes, voltage and candle power? The old type of open arc lamp requires 10 amperes and 45 to 50 volts (500 watts) to produce what is known as 2000 nominal candle power. The enclosed arc lamp with clear globes requires 7 amperes and about 70 volts (500 watts) to produce the same nominal candle power. While the enclosed lamp requires a voltage about 20 per cent. higher, the amperage may be reduced accordingly. While this reduces the number of lamps that can be worked at a given voltage there is an advantage, especially if the circuits are very long, as the line loss is cut down considerably. If a 1200-cp system is wanted the power consumption can be brought down to about 300 to 325 watts (4 amperes at 80 volts, or 5 amperes at from 68 to 77 volts). A shunt wound high tension series enclosed arc lamp can be so designed that it will operate with the same arc voltage, even though the amperage may vary by 40 per cent. The advantage of this is obvious. To-day almost any manufacturer of arc dynamos will furnish regulators by an adjustment of which the amperage may be changed from, say, 4½ to 6½ amperes and the dynamos will hold their current very steadily at any point. This enables one to get an arc circuit of controllable candle power, which may be varied at will from the station.

On dark nights the dynamos may be run at 7 amperes. The next night may be moonlight, when the current may be cut down to 5 or 6 amperes; during the winter when snow is on the ground there will not be needed more than 5½ amperes during the darkest nights. On moonlight nights with snow on the ground one could probably go as low as 4½ amperes and still light the streets as well as on very dark nights with 7 amperes. This feature of this system will save a station or a town a good many dollars.

Two hundred lamps, working at 70 volts each, require 35 kilowatts more with 7 amperes on the circuit than with 4½ amperes. If the plant produces one electrical hp hour from 4 pounds of coal, there would be saved during an eleven-hour run on 4½ amperes instead of 7 amperes, about 1 ton of coal, worth perhaps $2. By the use of this system a great many plants which now shut down at midnight might be able to charge the town which they light a little more and run on a low amperage the rest of the night, and then it might be profitable to run an all-night incandescent circuit. Lighting plants in small towns could undoubtedly get many new customers on their incandescent circuits if they could afford to run until daylight instead of shutting down at 12 P. M. There are many stations which have 4 to 7 ampere dynamos that are not in use, for, as the town grows the requirements change, more light is wanted and a 10-ampere arc system has to be put in. These could be fixed up and used with enclosed arcs to advantage. If more 2000-cp arc lamps are wanted, the old 6½-ampere dynamos can be used with enclosed arcs to supply them, thus saving the cost of new generators.

Another great advantage is the saving in carbons and the lower cost of trimming, since such a lamp operates for 125 hours without any attention. At each trimming there is only used one 12-inch by ½-inch carbon. The cost of such carbons is between $27 and $30 per thousand; consequently a lamp of this kind, if operated ten hours every night in the year, will consume thirty of these carbons per year, worth at highest carbon price 90 cents. If the carbons for the old type open arc lamps cost $15 per thousand pair, delivered, a lamp of that type which consumes one pair of carbons each night of ten hours requires 365 pair for one year, costing $5.47, thus showing a saving for the enclosed arc of over $4 each year per lamp in carbons alone.

As the enclosed arc only needs trimming once every ten or fifteen days, one or more trimmers may be dispensed with. The enclosed arc having an inner globe, a deduction from this saving of about $1 per year for each lamp might be made to allow for increased breakage.

Electric Protection for Banks.

BY JAMES H. HOWARD.

There are several electric burglar alarm systems in use, of which perhaps the most valuable is that using a mesh of conducting wires interwoven and covered with cloth, forming a curtain with which the safe may be covered or the interior of the vault lined. The cutting of any such curtain breaks the circuit and gives the alarm. The curtain may also be constructed with two solid tinfoil sheets and an insulating medium between then, or a single tinfoil sheet and a mesh of insulated conducting wires spread over it. Any cutting of such a curtain either opens the circuit or short circuits the two sides of the system between which a resistance should be inserted so that either effect will make such a change in the circuit resistance that it will sound the alarm. The doors of the safe may be lined with wooden shutters carrying suitable conducting wires attached to metal points of contact, which suitably close the circuit when closed and open it when disturbed. Some curtains of this kind have been made with a tinfoil sheet and wires run in one direction across the other side of the curtain. Such a curtain can with care be cut parallel with the wires and opened out without disturbing the circuit. A more suitable arrangement is that with wires run back and forth vertically on one side and horizontally on the other side, thus crossing each other, making a mesh which cannot be cut in any direction without disturbing the circuit. These wire sheets should be mounted on the two sides of a cloth curtain, the whole covered again with cloth on both sides, painted and again covered with thin strips of wood grooved and wired together at top and bottom to give suitable mechanical protection. The several breadths of the curtain should also be sewed together with fine insulated wires which may be put into the circuit.

The circuits should preferably be completed by leading the two terminal wires by different routes to the alarm station. The system may be further complicated, so that burglars with a knowledge of electricity cannot tamper with it, by inserting false wires in the conduit. At the station where the alarm is to be given there should be inserted in the circuit a relay or relays to respond to either a marked increase or decrease of the current, with suitable local circuits, annunciator drops, etc., in case several points are under protection. To prevent the insertion of a resistance across the circuit equal to that between the two sides of the protecting curtain and the cutting out of the latter, which could be done gradually without giving an alarm, there may be placed in the vault a variable resistance, changed preferably by clockwork. To prevent this variation acting upon the relay, there may be placed in the same circuit at the central station another variable resistance, also acted upon by clockwork, the two being so arranged that the total resistance of the circuit remains constant. It is useless, of course, to rely on a variable resistance device at the alarm station only, as the resistance in the safe would always remain the same and there would be nothing gained.

Too much confidence is often placed in electrical devices by those who do not understand them, but think that because they are electric they must be very difficult to overcome.

The Manufacture of Diamonds.

In the last volume of the Proceedings of the Royal Institution there appears a paper by Sir William Crookes describing the formation of diamonds by what is known as the Moissan process. The carbon is dissolved in molten iron and as the iron cools it separates out in one or more of its various amorphous forms, dependent largely on the conditions. A very great pressure seems to compress the carbon into its most densely constituted crystalline form, viz., the diamond. The actual process consists in packing pure charcoal with the purest of iron in a carbon crucible and melting the contents in an electric furnace. The crucible is then removed and plunged into water, thus solidifying the outer surface of the iron. As iron expands on solidification, the inner part of the mass in cooling exerts an enormous pressure, and the dissolved carbon crystallizes out in small diamonds. The largest diamonds thus obtainable so far are only about one-thirtieth of an inch in diameter.

Proceedings of the Laredo Convention.

The joint annual convention of the Texas Gas and Electric Light Association and the Texas Street Railway Association was held in Laredo, Tex., on March 9, 10 and 11. Although Mexico was not embraced in the territory represented by the two associations a cordial invitation had been extended the electric light and street railway men of the sister republic to attend the convention. This hospitable invitation met with a liberal response, nearly 100 visitors from different parts of Mexico being present. The largest delegation from that country came from the distant city of Gaudalajara, and it was composed of representative Mexican business men, who are interested in the electric light and street railway system of that city.

THE SESSIONS OF THE FIRST DAY, MARCH 9.

The convention was called to order in Exhibition Hall at 9:30 A. M. on March 9, by Mr. L. T. Fuller, of Calvert, Tex., president of the Texas Gas and Electric Light Association.

Mayor Christian was introduced to the convention and delivered an address of welcome in behalf of the citizens of Laredo, a response to which was made by Mr. Carl F. Drake, president of the Texas Street Railway Association.

Senor Antonio de la Fuente, of Nonclova, Mexico, delivered an address in Spanish on behalf of the Mexican visitors, welcoming the American delegates to the border country, a response to this address being made by Mr. L. T. Fuller. In the address by President Fuller, the speaker suggested that each company throughout the State file with the secretary of the association each year, about thirty days before the annual meeting, a schedule of the prices charged for gas and electric current for all purposes, and any rules or regulations governing the installations, these reports and others giving the capacity of all the plants and appurtenances, with all changes and improvements made during the year, to be the property of the association.

The reports of the executive committee of each of the associations were then presented and adopted.

Mr. Carl F. Drake, of Austin, Tex., president of the Texas Street Railway Association, addressed the convention on the subject of "Advantages of Associate Work."

The first evening session of the convention was devoted to a lecture by Mr. J. R. Cox, of Galveston, on the subject of "Calcium Carbide and Acetylene Gas," illustrated with experiments. The attendance at this session was very large and the music by the military band from the City of Mexico was a feature of the occasion.

THE SESSIONS OF THE SECOND DAY, MARCH 10.

The morning session of the joint convention convened at 9 o'clock.

Mr. George H. Cushman, of San Antonio, read an interesting paper on the subject of "Uniform Voltage and Continuous Service," from which the following is abstracted:

Uniform voltage and continuous service is the dream of every central station manager, but its realization seems to be just beyond his reach, because he can never get the stockholders to see its importance as he does. On this kind of service to the public depends the very life of the industry. Who would patronize a station whose lights go out for a few minutes or perhaps hours once a week or once a month, or whose light was continuously going up and down, or one which gave a poor light during those hours when a good light was most needed? Good service requires a well-equipped station, with duplicate boilers, engines and generators. The engines should regulate closely under varying loads, and the generators should be compounded to give the desired voltage at all times at the centre of distribution. An excessive drop should not be allowed in the feeders and mains. As the load rises with increase of customers more copper should be added to the lines.

Papers were also read on the subject of "Trucks and Their Maintenance," by Mr. George D. Hartson, of Dallas, and on the subject of "Street Mains and Service," by Mr. J. H. Fitzgerald, of Houston.

The afternoon session convened at 2 o'clock.

Secretary and Treasurer W. E. Holmes, of Austin, presented his annual report, and a number of applications for membership were presented and favorably acted upon.

A paper on the subject of "Car Bodies, Their Maintenance and Repair," by Mr. F. E. Scovill, of Austin, was then read, the following points being of special interest:

To maintain car bodies properly every system should have at least one extra body to every five cars in service in order to be able to spare one or more at any time for repairs.

Car bodies that are used in this climate must of necessity have more attention and greater care than those used in most other parts of the country, owing to the long and continued hot seasons. The hot sun is exceedingly hard on woodwork and paints. Continued drouths often lasting five or six months at a time cause joints to open and paints to crack and peel, and in many sections of our State the alkali or lime dust is very destructive to the interior finish of the car, and experience has taught us that plush or cloth cushions are in all cases to be avoided.

All car bodies should go into the shop once each month, the bolts and screws should be tightened, and at least twice each year all marred and grazed spots should be touched up with paint and the body be given two good coats of varnish. This will preserve the paint and the car will look nearly as well as when it first came from the repair shop. In this way car bodies can be kept in good condition for four or five years, even in a climate like this. Owing to the small rail, low joints, bad track and general faulty construction, which is the rule rather than the exception in the cities of this State, it is especially necessary that extraordinary care and diligence should be used in the repair and maintenance of car bodies. There has been a disposition in the past on the part of our Legislature to somewhat hamper the operation of street railways, and some three or four years ago there was introduced into the Legislature of this State a bill to force all systems to operate either open or closed cars during certain months of the year, thus necessitating a double equipment, something no line can afford, and had this measure become a law it would have forced us to materially contract our service, much to the inconvenience of our patrons and a material loss to ourselves. Municipal governments also seem disposed in some cases to adopt a similar course and we believe as much to the detriment of the people as to themselves.

Mr. Carl F. Drake made an address in which he advocated the use of pine ties in street railway construction.

Mr. Thomas Miller, of Dallas, read a paper on the subject of "Instantaneous Water Heaters," which was followed by a paper on the subject of "Experiments in Efficiencies," prepared by Mr. E. F. Gibbons, of Corpus Christi, Tex. This paper was abstracted in the last issue of THE ELECTRICAL WORLD.

THE SESSIONS OF THE THIRD DAY, MARCH 11.

The convention was called to order at 10 A. M..

The consolidation of the two associations was considered, and, after some discussion effected.

The constitution was amended to permit street railway corporations to become members, through representatives; also to extend the territory of the consolidated association to cover all of the Southern States and Mexico.

The joint convention of the two associations then adjourned sine die, and those present were immediately reconvened for the purpose of organizing the consolidated association.

While the committee on permanent organization formulated its report Mr. Drake presented the following resolution, which was unanimously adopted:

Be it resolved, that the representatives of the gas, electrical and street railway industries, in convention assembled, realizing that the erroneous impression has gone abroad that the profits of these industries in Texas are large, we declare that the history of the investments in these enterprises shows that they have not so far been as profitable as other commercial investments of less risk and depreciation, and we earnestly urge the people and respectfully ask from them a hearty co-operation, to the end that our State shall be able to keep up with the march of progress and development.

Mr. E. L. Wells, of Marshall, Tex., read a paper on the subject of "Rates for Electric Lighting." This paper was abstracted in the last issue of THE ELECTRICAL WORLD.

Papers on the subject of "Rail Bonding as a Power Saver," by Mr. H. C. Chase, of Houston, and "Ties, Their Life and Preservation," by Mr. D. D. Willis, of San Antonio, were read.

The committee on permanent organization then made its report, proposing that the name of the consolidated organization be the Southwestern Light and Street Railway Association and that its territory embrace all of the Southern States and Mexico. This recommendation was adopted. The following officers of the new association for the ensuing year were recommended and unanimously elected:

Mr. Carl F. Drake, Austin, Tex., president.
Mr. J. H. Fitzgerald, Houston, Tex., first vice-president.
Mr. E. Duestrod, Monterey, Mexico, second vice-president.
Mr. W. H. Weiss, San Antonio, Tex., third vice-president.
Mr. E. L. Wells, of Marshall, Tex., secretary.
Mr. F. Fries, San Antonio, Tex., treasurer.

It was voted that the association meet next year in Austin.

The convention then adjourned sine die.

Digest of Current Electrical Literature

American and Foreign.

by Carl Hering.

Dynamos, Motors and Transformers.

STARTING SINGLE-PHASE MOTORS. Kolben. "Elek. Zeit.," March 3.—A communication in which he gives with the aid of a diagram the rules which have been published for a year and a half in connection with the motors made by his company and showing how the starting apparatus is to be connected and used. He states that the method recently described by Arno was generally known long ago.

COMMUTATION OF CONTINUOUS CURRENT DYNAMOS. Housman. Lond. "Elec.," March 4.—A short communication offering a proof of his statements which were criticised in the article noticed in the "Digest," last week.

DESIGNING OF SMALL DYNAMOS AND MOTORS. Poole. "Am. Elec.," March.—A simple method for designing small machines; the reluctance is not calculated, a table of ampere-turns per inch of length for various materials at different densities being given. Approximate data are given for the dimensions of the armature and field magnet for machines from one-sixteenth to one-half horse-power.

SMALL BATTERY MOTORS. Dennis. "Sc. Am.," March 19.—A short description of the method which he has used for a number of years for running small motors from a primary battery; he claims that it is useless to try to run them from the battery direct, but with the additional use of accumulators it becomes quite practical; he gives an itemized list of his expenses, which were about $34 for the accumulators and primary batteries complete, and the annual expenses were about $16, which is a little over $5 per year per motor, the power being used mostly for sewing machines; the ordinary blue stone gravity battery was used.

ARC MACHINE AIR BLAST. Sterling. "Amer. Elec.," March.—The writer states that a weak feature of the T.-H. machine is the air blast. Two defects in the T.-H. air blast, which are weak blast and heating, can, it is stated, be traced to one point, and the remedy for this defect is given, which consists in the insertion of two dovetail pieces of babbitt metal in the internal surface of the hub.

EXPLORING THE POTENTIAL AROUND THE COMMUTATOR. McKissick. "Amer. Elec.," March.—The practical application of the Mordey method is illustrated and described; curves of potential are given taken by this method for zero load and three-quarter load.

ARMATURE WINDINGS AND CONNECTIONS. Rice. "Amer. Elec.," March.—Two layer and multipolar windings are illustrated and described.

Lights and Lighting.

STREET LIGHTING.—Lond. "Lightning," March 3.—This special number of that journal is devoted to street lighting by electricity. In a brief introduction a table is given showing the number of towns, population, lights, etc., in each State of the United States and a comparison made with some English towns, showing that the population per lamp is very much greater in the latter than in the former. This is followed by a large number of short illustrated articles on street lighting in a large number of English towns, most of the illustrations showing the methods of suspension of arc lamps.

NERNST LAMP. Schoop. "Elek. Anz.," March 6.—A note stating that in some experiments made fifteen years ago with a lamp in which a thin rod of magnesia was heated in an oxy-hydrogen flame he noticed that the amount of light emitted diminished steadily, the faster the higher the temperature, and he suggests that this might also be a serious fault of the lamp recently proposed by Nernst.

ILLUMINATION IN A ROOM. I. C. Thompson. "Elec. Eng.," March 7.—A short illustrated article giving the results of a number of measurements and calculations. He calls attention to the absence in specifications of figures denoting the required illumination, and he recommends more definiteness in such specifications. According to Siemens, a floor space of 5 square feet per candle is sufficient; Uppenborn gives 5 to 7 square foot; Kermanner and Prausnitz state that 0.73 to 0.83 foot candles horizontal illumination is sufficient for all ordinary purposes, and that 0.90 to 0.95 is sufficient for reading and writing; Cohn recommends about 1 foot candle, but this is seldom attained in practice by general illumination, as separate lamps, giving nearly twice that amount, are usually installed where bright light is necessary. He then made photometric measurements in a room with a lamp in the centre, the photometer being moved in a horizontal plane in which the illumination was measured; the results are given for a bare lamp and with a shade pointing upwards and downwards, but the method was not satisfactory and the theoretical curves were therefore deduced; these curves are reproduced; a comparison showed a considerable amount of ceiling reflection; by using a conical shade inverted, transmitting part of the light and reflecting the remainder to the ceiling, the illumination was reduced from 33 per cent. to 10 per cent., but the effect was admirable and eminently adapted for room illumination; all the average illumination was 0.52 foot candles; the light was soft and easy on the eyes. Other tests were made and showed how great an effect the kind and position of a shade has upon the light; it is concluded that it is probable that the best shade for diffused lighting is an inverted conical glass shade with straight sides having an angular opening of about 90°, ground on the outside, thus transmitting more light than an opal shade and reflecting the remainder against a light colored or white ceiling, the bulb itself being concealed; it scarcely pays to use a lamp of 32 candle power or higher, it being better to raise or lower the bulb; 2.6 foot candles is certainly enough for reading, and a mean general illumination of 0.5 foot candles for other purposes.

INCANDESCENT LAMP FILAMENTS. Shedd. "Amer. Elec.," March.—The manufacture and treatment of incandescent lamp filaments are treated in a general way.

Power.

REFUSE DESTRUCTORS.—Lond. "Elec. Rev.," March 4.—In a short communication by Hetherington he points out the advantages of compressing the sludge before combustion.

ELECTRICITY IN MINING OPERATIONS. Perrine. "West. Elec.," March 12; reprinted from the "Eng'ing Jour."—A short article of a general character calling attention to the lack of technical electric training on the part of mining engineers and superintendents; he claims that the mining engineer must acquire this training, as electricity is being introduced largely in mining operations. He gives a brief review of the present condition of the field, and among other things states that the electric percussion drill is a failure in underground working; there is room for great improvement in a good cheap wire cable, which is yet to be developed for the conditions existing in mines; the electric elevator applied to mines and operated from a long distance power plant is not yet entirely successful; nor will every series parallel controller be available for such use.

DOLGEVILLE, N. Y.—"Elec. Eng.," March 17.—An illustrated description of the new 3500-hp water power plant used locally and for transmission to Utica, 20 miles distant, where it may ultimately be used for railway purposes also; the two-phase alternating current system is used, the currents being generated at 2400 volts and transmitted at 10,000 volts.

HUNTER ALTERNATING CURRENT PATENTS. Hunter. "Amer. Elec.," March.—A reply to an editorial criticism. Hunter claims that his alternating current patents date from August, 1881, and therefore have priority over those of Gaulard and Gibbs or Zipernowski and Deri. He states that it was by his act that his railway patents were withdrawn in the suit of the Thomson-Houston Electric Company vs. the East Reading Railway Company, in which suit subsequently the prosecution based their case upon the Van Depoele railway patents.

Traction.

CENTRAL LONDON RAILWAY.—Lond. "Engineering," March 4.—The conclusion of the illustrated article on this underground railway, the present portion including the main part of the machinery in the central station and the transmission; it is very well illustrated with working drawings. An illustrated paper published in this country was noticed in the "Digest," last week. Large drawings of the generator and transformer are also given in the Lond. "Elec. Eng.," March 4. A number of illustrations, accompanied by a brief description, are also given in the "Elec. Eng.," N. Y., March 17.

TRAVELING PLATFORM.—"L'Energie Elec.," Feb. 16.—An illustrated description of the two speed traveling platform proposed for the Paris exposition; a description was noticed in the "Digest," Feb. 25. The other propositions for a railway through that exhibition are also described briefly.

LIVERPOOL RAILWAY.—Lond. "Elec.," March 4.—An analysis of the accounts of this elevated railway. A comparison of the previous half year shows improvements in many important respects.

MECHANICAL FEATURES OF ELECTRICAL TRACTION.—Lond. "Elec.," March 4.—A reprint of the discussion of Dawson's paper, read some months ago, and duly noticed at the time.

ELECTRIC RAILWAY FEEDERS. Hanchett. "Amer. Elec.," March.—Simple rules are given for the determination of the section of steel rail feeders. It is stated that the cost of a steel feeder is about one-third that of an equivalent copper feeder. A rule given is to divide .00055 by the weight of the rail in pounds per yard, which will give the resistance in ohms per foot. To find the equivalent cable or the size of a copper bond which will have equal

conductivity per unit of length, the weight of the rail per yard is multiplied by 100,000 and the product divided by 55, which gives the circular mils. To determine the weight of a 60-pound rail in tons per mile, multiply by .88. A table accompanying the article gives the size of copper bonds corresponding to various cross sections of steel rails, together with the cost of the bond.

STORAGE BATTERY CARS.—"West. Elec.," March 12.—Brief illustrated descriptions of some of the auxiliary cars on the Chicago road, including a snow sweeper and a parlor or funeral car.

ELECTRIC RAILWAY PRACTICE. Parham. "Amer. Elec.," March.—Difficulties incidental to starting a car on its initial trip are enumerated and methods given for locating them.

Installations, Systems and Appliances.

SYNCHRONIZING ALTERNATORS. Kensit. Lond. "Elec.," March 4.—A reply to the recent criticisms of H. H. N. (see "Digest," last week). He still claims that the distribution of the load can be made entirely by the excitation, stating that he and others do this daily; he also offers an explanation of how it is accomplished; there is the governing due to the centrifugal governor, and also that due to the synchronizing current between the two alternators.

CENTRAL STATIONS IN SWITZERLAND.—"Zeit. f. Beleucht.," Feb. 28.—A large full page table of statistics of a number of the Swiss stations connected with the Union. It shows the very large extension of the alternating current system; the original power is chiefly water power, but notwithstanding this the charges with some exceptions are quite high; the electric light and motor are very popular in that country.

MUNICH. Uppenborn. "Elek. Zeit.," March 3.—A long well illustrated description of the stations at present under construction for that city; the three-phase current at 5000 volts will be used with five sub-stations where the current is transformed into continuous current; accumulators are also to be used.

BRADFORD AND RICHMOND.—Lond. "Elec.," March 4.—An analysis of the accounts of the Bradford municipal station and of the one at Richmond belonging to a private company.

HIGH VS. LOW FREQUENCY.—Lond. "Elec. Eng.," March 4.—Several answers to a request to discuss the advantages and disadvantages of high and low frequency for supplying lamps and motors.

STEAM PIPING FOR CENTRAL STATIONS.—Lond. "Elec. Eng.," March 4.—Several answers to a call for descriptions of the best systems, accompanied by sketches.

WATER POWER, LIGHT AND POWER PLANT. Dailey. "Amer. Elec.," March.—Description of a plant in the small town of Delta, near York, Pa. The power is transmitted from a waterfall 5 miles distant at a voltage of 5000, which is stepped down to 450 at the sub-station in the town. Induction motors are run from the primary; the three-wire system is used for incandescent lighting, and the street lights run from the two outer mains.

METHOD OF HANDLING METERS. Draper. "Elec. Rev.," March 16.—The beginning of an article in which he describes how the meter department of a large central station is managed.

STORAGE BATTERIES IN ISOLATED ELECTRIC PLANTS. Blizard. "Amer. Elec.," March.—The advantages of a storage battery auxiliary in an electric lighting plant are pointed out, and a large number of instances given where the storage battery may be applied with profit.

MAZARRON.—"El'ty," March 16.—An abstract without the illustrations of the descriptive article noticed in the "Digest," last week.

Wires, Wiring and Conduits.

CURRENTS FOR FUSING WIRES. Murdock. Lond. "Elec. Rev.," March 4.—An interesting deduction from the table published by Preece in 1888; this table gives the fusing currents for a number of metals and sizes of wire, and the present writer deduces from these the following interesting relations, which however are only approximate: The current required to fuse platinum is one-half that for copper; that for tin is one-sixth that for copper, that for iron one-third, for lead one-eighth, and for aluminum one and one-half; all that it is necessary to know therefore is the fusing current for copper and these multipliers; the table of the original values is also reprinted. A curious fact is that if the currents necessary to fuse a given wire of iron, tin and platinum are added together, their sum is approximately equal to that for copper.

DIAGRAMS OF ELECTRICAL CONNECTIONS.—"Amer. Elec.," March.—Series, parallel and three-wire distribution are illustrated by nineteen diagrams of circuits.

TIGHTENING WIRE. Schweigger. "Amer. Elec.," March.—It is shown how with a rope, and a hitch and bend, a wire may be drawn taut in the absence of a "come along."

INTERIOR WIRING. Knox. "Amer. Elec.," March.—Systems and methods of wiring are treated in the current installment of this serial.

Electro-Physics and Magnetism.

PASSAGE OF ELECTRICITY THROUGH VERY SMALL GAPS. Salvioni. "Elek. Zeit.," March 3, and "L'Eclairage Elec.," March 5.—A long abstract, with a number of illustrations, from an Italian medical journal. He investigated the conditions under which a continuous flow of current is obtained across a gap of several ten-thousands of a millimetre. For electrodes he used balls of platinum amalgamated by making an arc pass between the platinum wire as a positive pole, and a surface of mercury; to adjust the distance between the balls he used the unequal expansion between two different metals due to heat, the distance being calculated from the temperature; the battery consisted of 300 copper-zinc cells which were variously grouped. His results showed that if the current has been made to pass, then the current from much fewer cells will continue to pass even though the gap be increased; this is similar to the well-known results for spark gaps, but there is a difference in that the conductivity caused by the first spark is a lasting one, as it continues several hours; if it required 300 cells to start a current, then a single cell would suffice to continue the flow of current; a small mechanical vibration will suffice to start the current; after the current has been passed, a small vibration will again destroy the conductivity; it therefore acts as a sort of coherer. It is supposed that the passage of a spark produces a conducting band between the knobs, which tears by mechanical vibrations, or by stretching beyond a certain limit. In conclusion, he gives a curve showing the relation between the number of cells and the gaps over which they can no longer start a current.

CONDUCTIVITY OF THIN LAYERS OF LIQUID. Bryan. "Phil. Mag.," March.—Koller found that in certain liquids the conductivity decreases as the thickness of the layer was decreased; the present writer repeated these experiments, describing and illustrating the apparatus, as also a new form, and found that the differences in the conductivities for different thicknesses were greatly reduced; the readings depend greatly on the cleanliness of the plates; for a dilute solution of alcohol and aniline the conductivity is the same for all thicknesses within the range of the experiments; using true and clean plates, and an alternating current, the differences found by Koller were eliminated.

ELECTROMAGNETIC THEORY. Heaviside. Lond. "Elec.," Jan. 14 and Feb. 18.—A continuation of his long, highly mathematical series of articles; these are being continued in occasional numbers of that journal, and will not again be noticed here.

POTENTIAL GRADIENTS IN VACUUM TUBES. Graham. "Wied. Ann.," 1; abstracted briefly in the Lond. "Elec.," March 4.—He made some interesting and instructive determinations of the fall of potential along the path of a vacuum discharge, partly by means of probes and partly with movable electrodes; in the positive part of the discharge the potential gradient is smaller for the dark than for the bright strata; a matter of interest was the presence of free charges at various points along the path.

DISCHARGE ACTION OF ULTRA-VIOLET LIGHT. Zeleny. "Phil. Mag.," March.—A very brief description of experiments made to compare the electrical properties of air through which a body is being discharged by the action of ultra-violet light, with those when Röntgen rays cause the discharge.

URANIUM. Kelvin, Beattie and Smolan. "Phil. Mag.," March.—A short paper describing experiments with the electric equilibrium between uranium and an insulated metal in its neighborhood. The results agree with those in a recent paper by Becquerel.

CANAL RAYS. Goldstein. Lond. "Elec.," March 4; abstracted from the "Wied. Ann.," 1.—A complete dissertation on this kind of radiation, which forms the yellow layers next to the cathode and which has never before been closely studied. He shows that this light may be obtained without admixture of the cathode light by dividing the vacuum into two parts; those rays produce no phosphorescence and are not reflected by a magnet.

COLORED ALKALINE HALOIDS. Wiedeman and Schmidt. "Wied. Ann.," 1; abstracted briefly in the Lond. "Elec.," March 4.—Alkaline salts acquire a coloration under the influence of electric discharges; several explanations were offered; the present authors suggested that the cause was the formation of sub-chlorides, and in the present article they discuss the whole question and apparently succeed in vindicating their chemical theory.

MODIFICATION OF SALTS EXPOSED TO CATHODE RAYS. Abegg. "L'Eclairage Elec.," Feb. 26; abstracted from the "Wied. Ann.," 62, p. 424.—In order to settle a controversy he repeated his former experiments, using the apparatus suggested by Goldstein.

ACTION OF RONTGEN RAYS ON VEGETABLES. Tolomei. "L'Eclairage Elec.," Feb. 26.—In previous experiments he believes the time of exposure had been too short; an exposure of thirty minutes per day during fifteen days, for instance, produced no appreciable results; he therefore made some tests to determine the quantity of gas disengaged by the action of the rays on a branch which was under water, counting the number of bubbles which escaped, and in this way he compared the effect of X-rays with those of sunlight; he found that the effect of the former was very slight, but that it was identical with that of light.

DISCHARGE BY X-RAYS. Perrin. "L'Eclairage Elec.," Feb. 26.—A reprint of a short Academy paper describing new experiments.

ELECTRICAL RESISTANCE IN MAGNETIC FIELDS. Beattie. "Phil. Mag.," March.—A long description, accompanied by numerous diagrams and tables, of some experiments, the object of which was to investigate the relation of the resistance variation to the magnetization of films of cobalt, nickel and iron, trans-

versely magnetized; some doubt existed as to this relation, but it was certain that in these three metals the variation is an increase when the resistance is measured parallel to the lines of magnetic force, and a decrease when perpendicular to them. His conclusions are that these metals show a change in their resistance when in a sufficiently strong transverse magnetic field; the variation is greatest in nickel and cobalt and least in iron; in cobalt films the Hall effect is proportional to the magnetization squared; in nickel the variation differs considerably with the specimens used, but there are signs of obtaining a maximum, although at a higher field than that required for the maximum Hall effect; moreover the variation becomes greater in some plates after they have been used; in iron the variation is less than proportional to the square of the magnetization.

MAGNETIC PROPERTIES OF ALMOST PURE IRON. Wilson. Lond. "Elec. Rev.," March 4.—A reprint of a short Royal Society paper. He gives the results of recent magnetic tests of almost pure iron, including hysteresis and permeability tests. In comparison with the hysteresis results obtained by Ewing for a transformer plate, which are exceptionally low, the present results were slightly inferior; the permeability on the other hand was exceptionally high, having a value of 5490 for B = 9000; an induction density of 15,270 for H equals 9.24 was obtained, and was higher than he had seen before; it was exceptionally good for values of H below 10 or 12. He noticed a very great apparent magnetic instability, and investigated this more closely, the greater portion of the paper referring to that; tapping the substance produced a considerable change of induction; after extended investigations he concluded that the effects were peculiar to the iron itself and were probably influenced by induced currents; the amplitude of the induction it would seem would not be so great for high frequencies and small induction density, a matter of importance in the case of iron for transformers.

X-RAY TUBES. Hutchins. "Elec. Rev.," March 16.—A brief account of some of the experiments conducted by him together with Robinson. After criticising some of the views expressed by Rollins in that journal, in which it is thought strictly scientific facts are confounded with what is more a matter of opinion, he describes his earlier work and then gives an illustrated description of a successful expedient to prevent the rise of vacuum in the tube; potash is not a solution of the problem, for the water driven out from it soon fails to return; he dusts the inside of the bulb with a finely powdered mineral which either gives off gases or occludes them; he uses smithsonite roasted to a dull red heat or spodumene; such tubes have been in continuous use for more than a year without the vacuum becoming too high, but the remedy is not perfect, and they therefore add a smaller tube containing a platinum wire and powdered calcite, the wire having an external connection; when the vacuum becomes too high the current is passed through this tube for a few seconds, which throws off carbonic acid gas.

ELECTRICITY. Weaver. "Amer. Elec.," March.—The popular idea is combated that electricity is a great mystery among the forces of nature, and it is pointed out that as much is known of electrical action as of heat and light, and more than is known concerning the mechanism of gravity. It is stated that in reality electricity is a mere word representing nothing definite, but corresponding in fact to the algebraic x; all that we really do know is that we can transform into what we call electrical energy several other forms of energy known as mechanical energy, heat and chemical or molecular energy. The efficiency of the dynamo of the primary battery and of the thermal generators could not be improved were a complete answer given to the question "What is electricity?" The only direction from which at present there appears any definite promise of increasing the efficiency of any of the several kinds of electrical transformation is from the oxidation of carbon without heat. The commercial problem of producing light without heat has thus far remained unsolved, and the difficulties in the way are such that it seems to be hopeless to produce light commercially by electrical means except through the intermediary of heat, either directly as in the arc and incandescent lamp, or by molecular impact, as in the vacuum tube; to obtain light without heat it would be necessary to produce vibrations in the ether of a frequency expressed in numbers by multiplying 5 by the fourteenth power of 10, while the highest frequency thus far obtained by means of disruptive discharge is .0001 of that number, corresponding to a wave length of 1 centimetre. The Marconi system is described, but an unfavorable answer is given to the question "Is there a probability that electrical energy for power purposes may in the future be transmitted by that process?" To transmit energy in this manner there would have to be a generator at one end and a motor at another, as at present; in addition, there would be a secondary transforming apparatus, and in such devices as these the losses at present are very great, much of the electrical energy being wasted in heat; moreover, if the vibrations could be economically set up in the ether, it is pointed out that there would be a great loss even were it at all practicable to so direct the vibrations that all the energy imparted to the ether will be utilized at the receiver.

IDLE CURRENT.—"Amer. Elec.," March.—The use of the term "idle current" is attacked, it being held that all of the current in any circuit is effective, though part of the impressed E. M. F. is idle in an inductive circuit, being nullified by the inductance. In the case of a motor, whether direct current or alternating current, there is a counter E. M. F., and if the impressed E. M. F. that balances this counter E. M. F. is cut down, more current must be sent through the machine if it is to continue to work at the same rate. If a direct current motor has its E. M. F. reduced from 100 to 80 volts, the current sent through it must be increased in approximately the inverse ratio, in order that the motor may develop the same power; and similarly, when inductance balances part of the E. M. F. supplied to an alternating current motor, the current must be increased to maintain the power. In both the above cases all the current does work; in the first case, the 20 volts are actually lacking, while in the second case they are present, but neutralized, being idle so far as the power of the machine is concerned.

INDUCTANCE AND CAPACITY IN PARALLEL.—"Amer. Elec.," March.—A simple method is given for the treatment of the problem of two inductances or two capacities in parallel, or of an inductance in parallel with a capacity. It is shown that if an inductance is in parallel with a condenser, the current is less than the numerical sum of the components, owing to the difference of phase. All the problems relating to the above cases are solved with reference to a right angle triangle and a triangle of which two sides and the included angle are known.

Electro-Chemistry and Batteries.

ALKALI PROCESS. Kershaw. Lond. "Elec.," March 4.—An able article on the Hulin process. In this process fused salt is used and it has the advantage of enabling very high current densities to be employed, and that there is an absence of secondary reactions at the fused lead cathode. The difficulties which originally arose in this process were that the fused mixture acted on the crucible and that the cathode surface could not be kept clean, as the fused lead cathode became entirely crusted with the alloy, after which no more sodium was absorbed by the lead; these faults have now been overcome in the present process; a definite proportion of lead chloride was added to the electrolyte, thus depositing both lead and sodium simultaneously. The process has been in operation on a small scale at Modane, France; each crucible requires 7 volts, and the current density was about 700 amperes per square foot, which is thirty times that with aqueous solutions and indicates that an output thirty times as great could be obtained per plant with an equal cathode area. To keep up the supply of lead chloride 12 per cent. of the current is led through the crucible from a lead anode; the yield was 1.85 kg. of chlorine and 1. 24 of sodium per horse-power day of 23 hours. The sodium is extracted with water instead of steam; lead peroxide and spongy lead are easily obtained as a by-product, while the hydrogen given off might also be used; he has obtained sodium hydrate solutions of a specific gravity of 1.54 without any concentration by external heating. The efficiencies and cost are discussed and the former are shown to be lower than in other processes in use; a comparison is given in a table, which shows that while with the wet process it is slightly over 50 per cent., in the Hulin process it is 41.5 per cent., but the advantages which compensate for this are that a much greater output per plant is obtained, that the soda solution is concentrated without evaporation, and that there are by-products of a commercial value; compartive figures are also given for the cost of the electrical energy in the different processes, showing it to be more than twice as great for the Hulin process, against which the money value of the advantages should be credited. The results are sufficiently successful that a large plant of 5000 horse-power, obtained from water power, is at present under construction at Clavaux, Isere, where an output of 4 tons of soda and 8 tons of bleach are expected.

ELECTRO-METALLURGICAL PROCESSES. Tommassi. A publication in French, in pamphlet form, describing at length his process for the extraction, separation and refining of metals; for the desilverization of lead; and for the electrolytic preparation of spongy lead, oxides of lead and white lead. Publications of descriptions of some of these processes have already been referred to in the "Digest;" in the present pamphlet these are reprinted.

MANUFACTURING ALUMINUM AND ITS SULPHIDES. Peniakoff. Lond. "Elec. Rev.," Feb. 25.—A brief abstract of his process, which has recently been successfully carried out in Belgium. The essential features are that a single and anhydrous aluminum salt, such as a fluoride or chloride, fused with the sulphide of an alkali, with a chloride or fluoride as a flux, yields a mixture containing aluminum sulphide, from which aluminum may be reduced either by the electric current or by reducing gases.

ANALYSIS OF COPPER NICKEL ALLOYS. Riche. "Zeit. f. Electrochemie," Feb. 5.—A brief notice of a paper from the "J. Pharm. Chimie," 6, p. 300. The copper is first precipitated electrolytically from the sulphuric acid solution and the nickel is then precipitated with an excess of ammonia.

ELECTROLYTIC SEPARATION OF NICKEL AND COBALT FROM IRON. Ducru. "Zeit. f. Elektrochemie," Feb. 5.—A brief abstract of an article from the "Bul. Soc. Chim. de Paris," 17, p. 881. A description of a method of analyzing nickel steel.

PURIFICATION OF THE ELECTROLYTE IN COPPER REFINING. Ulke. Lond. "Elec.," Feb. 11.—A translation in part of his recent paper, noticed in the "Digest," Feb. 5.

ELECTROLYSIS OF HYDRO-OXIDES OF SODIUM. Jahn. "Zeit. f. Elektrochemie," Feb. 5; abstracted briefly from the "Wied. Ann.," 63, p. 44.—He endeavored to determine whether the retardation of the development of hydrogen at the mercury electrode is due to the absorption of the hydrogen or to the formation of an alkali amalgam; the results seem to indicate that an equivalent amount of sodium amalgam was formed.

ELECTROLYSIS OF ALKALIES. Bell. "Zeit. f. Elektrochemie," Feb. 5.—A note describing briefly an apparatus for the

electrolysis of chlorine and chloride solutions, in which the anode is placed beneath the mercury cathode.

ALKALINE CARBIDES. Moissan. "L'Eclairage Elec.," Feb. 26.—A reprint of an Academy paper on the conditions for the formation of alkaline carbides and of the carbide of magnesium. This is followed by another one on the dissociation of carbide of calcium.

THEORY OF GALVANIC POLARIZATION. Oberbeck. "Zeit. f. Elektrochemie," Feb. 5; noticed briefly from the "Wied. Ann.," 63, p. 29.—A theoretical discussion, in which he concludes that the irregular polarization found by Streintz was easily explained.

HYDROLYTIC DISSOCIATION. Ley. "Zeit. f. Elektrochemie," Feb. 3; abstracted briefly from the "Berl. Ber.," 30, p. 2193.

CONDUCTIVITY OF AQUEOUS SOLUTIONS. Archibald. Lond. "Elec. Eng.," Feb. 11.—An abstract of the article noticed in the "Digest," Feb. 12.

DEPENDENCE OF CAPACITY OF DISCHARGE CURRENTS OF ACCUMULATORS. Loppe. "Elek. Zeit.," March 3.—A brief abstract including the results, from a French journal, on measurements to test the Peukert formula (see "Digest," June 19 and Aug, 14 and 21). He found that the results differed only by 3 per cent. from those calculated from the formula; he gives the value of n for eighteen different accumulators in Europe; the values varied from 1.2 to 2.0, averaging about 1.4.

MIGRATION OF CALLOIDS. Coehn and Euler. Lond. "Elec. Rev.," Feb. 25.—A brief abstract of the article noticed in the "Digest," Aug. 28.

ACCUMULATOR CONSTRUCTION. FitzGerald. Lond. "Elec. Eng.," March 4.—In this continuation of his long serial (see "Digest," March 19) he discusses the question of the density of the current, and shows that the best density depends on a number of conditions; taking as a unit the ampere per square inch, the maximum safe density of one form of the E. P. S. cell was less than 0.040; in another of these 0.046; for a battery of another maker it was 0.026; for the Tudor cell, neglecting the grooved surface, it was 0.27, the real density being 0.038; on the Paris lines 0.056 to 0.194 are used; he speaks of another battery, the name of which he does not give, in which 0.207 was quite safe.

PRECIPITATION BATTERIES. Vogel. "Zeit. f. Elektrochemie," Feb. 5.—A note supplementary to the article of Lorenz, abstracted in the "Digest," Feb. 5. He made a discovery some time ago that hydro-oxide of zinc was formed in a lead accumulator in which the negative electrode was replaced by one of zinc amalgam, the plates being horizontal.

FORMATION OF OZONE. Shenstone and Evans. Lond. "Elec. Eng.," March 4; abstracted briefly from the "Proc. of the Chem. Soc." A paper on the influence of the silent discharge on atmospheric air. They found that the air first contracts to a great extent and then re-expands rapidly to nearly its original volume, the residue containing a trace of nitric peroxide; 80 to 85 per cent. of the oxygen in the air may be readily ozonized; in the presence of moisture, or with great care, as much as 98 per cent.; if not pressed too far no nitric peroxide will be formed, but at a certain point, which nearly coincides with the point at which the ozone is at a maximum, it is formed; in its presence ozone is rapidly destroyed, as also the peroxide itself; the presence of moisture promotes the formation of ozone, but retards that of nitric peroxide; the presence of a trace of peroxide will make it impossible to ozonize the air; they used about 13,300 volts.

ELECTRO-CHEMISTRY IN 1897. Weyer. "Elektrochem. Zeit.," Feb. 1.—The conclusion of his summary (see "Digest," Feb. 5); it includes pyro electro-chemistry (electric furnaces, etc.), alkaline industry, inorganic and organic chemistry and chemical analysis, ending with a mention of some recent books on these subjects.

THE JACQUES CELL. Reed. "Amer. Elec.," March.—The position of Anthony concerning the function of oxygen in a Jacques cell is attacked, it being held that oxygen does not act directly as a depolarizer, but reoxidizes the iron, which becomes reduced by the electro-chemical reaction. The view of Dr. Julius Thomsen is contested that the Jacques cell evolves electrical energy as a galvanic battery, since this hypothesis is dependent upon the occlusion of oxygen on the iron without combining with it chemically; it is claimed that iron does not under any known condition occlude oxygen. In contradistinction to the above views it is held that there is no escape from the conclusion that the energy of the acques cell originates in heat and in heat only.

BEHAVIOR OF DRY CELLS. Wolcott-Heldt. "Amer. Elec.," March.—In reply to a question as to a supposed discrepancy of the behavior of some dry cells, it is pointed out that this was probably due to the voltmeter being an instrument of low grade, having only a small internal resistance; also to the fact that the voltage measured on open circuit will not correspond with that measured on closed circuit.

ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES. Kershaw. "El'ty," March 16.—In this instalment of his very long series (see "Digest," last week) he discusses the application to organic chemicals and dyes; in these the electric current is used only as an aid and not as a sole agency in the manufacture; in the production of such compounds oxidation and reduction play the most important part, and this is brought about by the current; a few examples of the methods which have been suggested are given briefly, as in connection with aniline; some processes depending on the introduction of the halogens are briefly referred to; the production of cyanides is also briefly discussed.

RELATION OF CHEMISTRY TO ELECTRICAL ENGINEERING. Burgess. "Wis. Eng.," Jan.—An article of a general nature, but containing apparently nothing new. Attention is called to the importance of cheap power for electro-chemical work and the various chemical changes effected by the electric current are classified and discussed separately.

Units, Measurements and Instruments.

BALLISTIC GALVANOMETER. Fry. Lond. "Elec. Rev.," March 4.—Determining the various constants of a ballistic galvanometer is a very troublesome and lengthy proceeding; in the present short article he describes a method, by means of which much of this work is simplified, as for instance when the constant is changed by shifting the telescope and scale; a portion of the formula for the constant is determined once for all, and the new constant is then readily determined from it. In another method described the ballistic constant may be determined from a standardized induction coil and a simple current measurement.

QUADRANT ELECTROMETER AS A WATTMETER AND VOLTMETER. Wilson. Lond. "Elec. Rev.," March 4.—The beginning of a reprint of a Royal Society paper. During the past seven years he has had continuous experience with the Kelvin form of instruments, and in the present paper he describes some of eter, and he found that the formula was verified within the range -mula for the variation of the deflection of the quadrant electrom- it. One of the applications is to the verification of Maxwell's for- of potential used. He shows with a diagram how it is used as a wattmeter with alternating currents and how it was tested when so used. No general conclusions are drawn.

MEASURING THE TEMPERATURE ON ELECTRODE SURFACES. Richarz and Ziehler. "Zeit. f. Elektrochemie," Feb. 5; abstracted briefly from the "Wied. Ann.," 63, p. 261.—Descriptions of experiments to determine the temperature of electrolytes at the surfaces of small electrodes. They found that the temperature increased with the current, and by calculating the corresponding resistance change they show how the errors in polarization masurements may be calculated.

CHANGE OF THE ZINC SULPHATE IN THE CLARK CELL. Jaeger. "Zeit. f. Elektrochemie," Feb. 5; abstracted briefly with the curves from the "Wied. Ann.," 63, p. 354.—It is well known that the zinc sulphate changes with the increase of volume by some of the water crystallizing out at a temperature of 39°, the solubility of the second salt being greater than that of the first and therefore the E. M. F. will be lower, below 39°, for the second form than for the first; the change in the temperature coefficient for both is shown in curves and the equations are given; similar relations are found with the cadmium cell.

LOCALIZATION OF FAULTS IN SUBMARINE CABLES. Schaefer. Lond. "Elec.," Feb. 25.—A reply to the criticisms of Murphy, noticed in the "Digest," Jan. 22.

MEASURING POLARIZATION CAPACITY. Gordon. "Zeit. f. Elektrochemie," Feb. 5.—An abstract of his article from the "Wied. Ann.," 61, p. 1.

COMMUTATING SWITCHES FOR LABORATORY WORK. Kollert. "Elek. Zeit.," March 3.—An illustrated description of a modification of the revolving commutating switch of Heim and its application to measurements based on the same principle as Ayrton's secohmmeter; he shows how it can be applied to compare the capacities of two condensers with each other by a well-known method in which an ordinary aperiodic galvanometer is used. Also to the measurement of mutual induction according to the method of Pirani and to the Hospitalier method of measuring battery resistance.

METER. Raps. "Elek. Zeit.," March 3.—A reprint, with illustrations, of a recent paper read before the Electrical Society, and describing the Siemens and Halske meter. The principle is that the deflected needle of an ampere meter is brought back to zero every three seconds, and the amount of the angle is registered; the way of overcoming the difficulties involved is described and a test of the accuracy showed variations of considerably less than 1 per cent. for larger currents and somewhat over this for a load of 3.3 per cent.

TEMPERATURE COMPENSATION OF STANDARD CELLS. Campbell. "Phil. Mag.," March.—A reprint of the complete paper, an abstract of which was noticed in the "Digest," Jan. 15.

WAVE LENGTH OF LIGHT AS A STANDARD OF LENGTH. Edser. Lond. "Elec. Eng.," March 4.—A description of the Michelson apparatus, which it is claimed can be applied with ease and certainty to measure the wave length accurately.

MAGNETIZING GALVANOMETER NEEDLES. Webb. "Amer. Elec.," March.—By the method given a 393-ohm galvanometer made by students was found to have a figure of merit of 91 by 10 to the minus tenth power; the part 91 can probably reduce by remagnetizing to 40.

DYNAMO TESTING.—"Amer. Elec.," March.—A method is described for testing for individual losses.

MEASURING THE LIGHT FOR PROJECTORS. Blondel and Rey. "Prog. Age," March 15.—A translation of the article abstracted in the "Digest," last week.

TESTING SET ADJUSTMENTS.—"Amer. Elec.," March.—Several methods are given for adjusting the resistance coils for a Wheatstone bridge described in a previous number.

A CHEAP TESTING SET.—"Amer. Elec.," March.—An easily made form of wire bridge is illustrated and described.

Telegraphy, Telephony and Signals.

DISTURBING CURRENTS IN TELEPHONES. Laarmann. "Elek. Anz.," Feb. 27.—An illustrated description of the Brockelt system for preventing the disturbing currents, such as are induced from neighboring lines, from affecting the telephone. It is based on the production of a counter induction, which reduces the objectionable currents to a small amount. The telephone is shunted by a coil which is a secondary of an induction coil, the primary of which is connected in series with the telephone and between it and the ground; the disturbing currents in the primary of that coil will induce currents in the secondary, which are in the opposite direction, and these currents will oppose the passage of the disturbing currents through the telephone, thereby compensating them. In a modification shown, the telephone itself is placed in a separate circuit including the secondary of another induction coil, the primary of which is placed where the telephone was in the first mentioned arrangement; both have given very good results in practice. It might at first seem as though the telephone currents would thereby be greatly weakened, but numerous experiments have shown that by a proper proportioning of the resistances and dimensions of the coils this is not the case, speech being clear and distinct.

GRAPHICAL METHOD OF SHOWING THE CURRENT IN SUBMARINE CABLES. Rossel. "Elek. Zeit.," March 5.—A long abstract with numerous illustrations of the article noticed in the "Digest," Nov. 13, 1897.

SUBMARINE CABLES.—Lond. "Elec. Rev.," March 4.—The first part of an article discussing the proposed direct cable from England to Australia and the Pacific cable project.

INDEPENDENT TELEPHONE MOVEMENT.—"West. Elec.," March 12.—Besides a number of notices there is given the first part of an article by Nate on the "telephone situation," in which he claims to show the true situation of telephone work and its various phases; in the present portion he discusses the organization, the equipment, and the exchange operation.

DETROIT TELEPHONE COMPANY.—"Elec. Eng'ing," March 15.—The beginning of an article discussing the official statements of the Detroit Company and the prospectus of the New State Telephone Company of Michigan; it is unfavorable to both of these.

AMERICAN TELEPHONE PRACTICE. Miller. "Amer. Elec.," March.—Switchboard details form the subject of the current installment of this series.

PRACTICAL FEATURES OF TELEPHONE WORK. Dobbs. "Elec. Eng.," March 17.—The first part of an article of a general character pointing out a number of "pitfalls in starting" independent plants.

ELECTRIC BELL ARRANGEMENT. Eastlake. "Amer. Elec.," March.—An arrangement is described for calling up watchmen by telephone, an annunciator and gong being installed for this purpose.

TESTS OF THE SYNCHRONOGRAPH. Crehore and Squier. "Jour. of Frank. Inst.," March.—The first part of the complete paper an abstract of which was published in THE ELECTRICAL WORLD, Jan. 29, 1898.

Miscellaneous.

PARABOLIC REFLECTORS.—Lond. "Elec.," March 4.—A reprint of the discussion of Cowper-Cowles' recent paper (see "Digest," March 12, and THE ELECTRICAL WORLD, March 5). The discussion contains nothing of importance; a number of the speakers expressed praise of the method; Grove suggested the use of a small reflector plated with palladium in place of the screen which is usually placed in front of the arc to cut off the direct rays.

DIRECT TRANSFORMATION OF HEAT INTO MECHANICAL ENERGY.—"L'Ind. Elec.," Feb. 25.—An unfavorable discussion by E. H. of the recent proposition of Deprez (see "Digest," Feb. 26 and March 5); he thinks it should be classed with the impractical pyro-magnetic generator of Edison.

ELECTRICAL INSPECTION. Sanborn. "Amer. Elec.," March.—The poor quality of underwriter inspection in New Hampshire is referred to, and it is recommended that for safety to the community there should be a municipal system of inspection, and that electricians should be compelled to pass an examination and receive a license before being allowed to work.

DEATH BY ELECTRICITY. Hedley. "El'ty," March 16.—A reprint of the article abstracted in the "Digest," March 12.

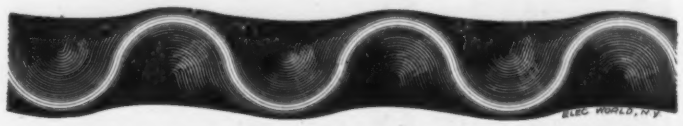
BLINDNESS FROM THE ELECTRIC ARC. Rowland. "Amer. Elec.," March.—The danger to eyesight from the light of the electric arc is discussed, and remedies are given for injuries to the eye thus made.

ELECTRICAL CATECHISM.—"Amer. Elec.," March.—The rotary transformer is the subject of the present installment of this series.

ELECTRICAL APPARATUS FOR AMUSEMENT. Hopkins. "Amer. Elec.," March.—The construction of a so-called spiritualistic cash box is given, being a variation of Houdin's electrical trick of the "light and heavy chest."

A Special Tube for Heat Transmission.

A simple and ingenious design of heat transmitting surface is shown in the accompanying diagram. It consists of a tube dented or buckled alternately in directions normal to each other and both normal to the axis of the tube. This, of course, does not increase in any way the surface of the tube, as might be thought at first sight, but increases the ratio of surface to cross section, which is the feature to be considered in the transmission of heat from a medium on

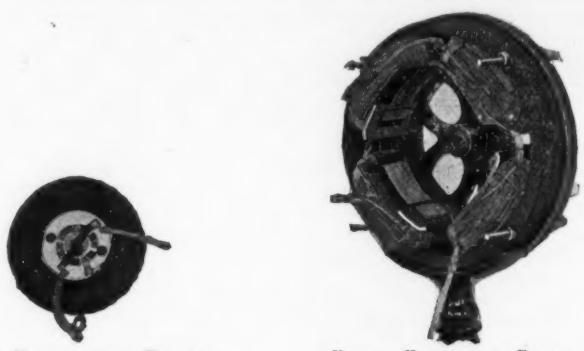


the outside to a medium on the inside of the tube. More than this, it causes an eddying or swirling motion of the fluid on either side of the tube, whether that fluid be a liquid or gas, and thereby breaks up the currents passing the tube surface and causes a much more rapid interchange of heat. The tube is also elastic in the direction of its length, and may therefore expand and contract between tube sheets without fear of starting a joint. It is said that a tube treated in this way will transmit twice as much heat in a given time as a plain round tube of the same surface. It is applicable to feed water heaters, evaporators, condensers, economizers, coolers, stills and every other style of apparatus designed for the transmission of heat through a separating wall. This tube is put on the market by the Dalham Works, Manchester, England.

Two Fan Motors of New Design.

The '98 models of the General Electric Company's fan motors are announced. These fan motors are built for both alternating and direct current circuits.

That for alternating currents is an induction motor, as carefully proportioned in all its parts as are the larger machines which this company builds, excessive wear and heating under continuous operation being as absent from the small as from the large. To the cast-iron frame which supports a single long bearing are bolted the soft iron laminations which make up the field core,



SPEED-REGULATING DEVICE. FIELD CORE AND COILS.

provided with inwardly projecting teeth to form the poles on which are placed the field coils wound with an ample quantity of wire and thoroughly insulated. The armature is built up also of soft iron laminations, assembled on a brass spider, but has no insulated wire. Bare copper rods run through the core, and are riveted into discs at each side. Rotation being produced by inductive action, no commutator or brushes are required. The armature overhangs the bearing, and with the fan rotates well balanced on the single bearing. An automatic oiling device gives perfect lubrication. The alternating fan motor is built for 52 and 104 volts, 60 and 125 cycles, and is provided with a speed-regulating device consisting of an inductive resistance cut in or out by a three-point switch. Movement of the switch over the first two points gives full speed and half speed, and on the third cuts the motor out of circuit.

The direct current fan motor is as equally compact and carefully designed

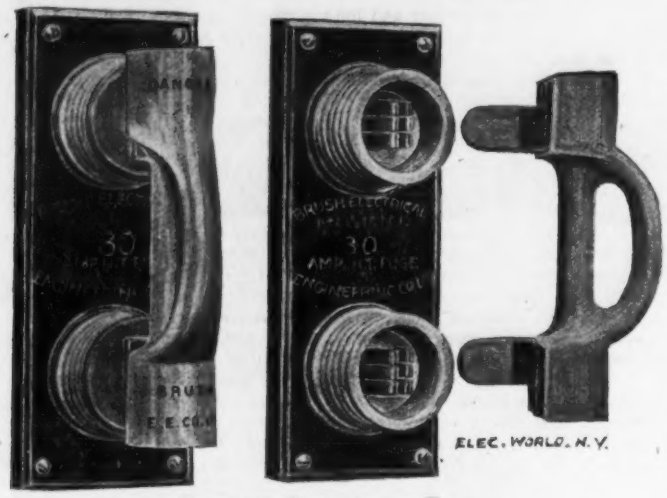
ARMATURE. SELF OILING BEARING.

as that for alternating currents, and in appearance and general construction closely resembles it. Laminated soft iron of the best quality is used throughout for the magnetic circuit; all windings are thoroughly insulated, and commutator connections carefully made. As in the alternating motor, fan and armature revolve in a single long self-oiling bearing. The commutator is completely enclosed, and the carbon brushes encased in small tubes, readily unscrewed for inspection. A regulating switch provides for variation of speeds. The alternating current fan motor may be, if desired, mounted on trunnions to allow of adjustment of the fan to blow in any direction.

The motors are finished in black enamel; the fan guard and trimmings in polished nickel.

Combined Switch and Fuse.

An ingenious combination of switch and fuse as manufactured by the Brush Engineering Company, Limited, of London, is shown in the accompanying illustration, the details of which are quite self-evident. The fuse is contained in a porcelain tube, fiitted with blades at either end, which can be inserted in



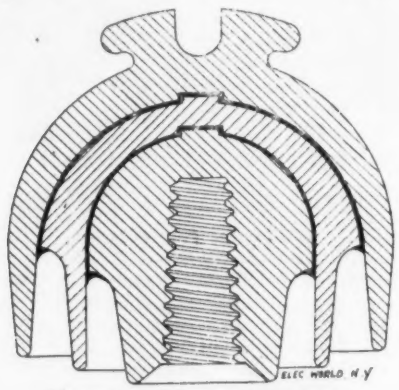
Combined Switch and Fuse.

spring clips attached to the circuit terminals, the porcelain tube being fitted with a handle by which the fuse holder and blades can be readily removed and re-fused with safety. The same device can obviously operate as a switch with an indefinitely long break.

A Multiple Glazed Insulator.

It is well known that porcelain insulators of high insulation resistance depend quite largely on the glazed surfaces covering them for their ability to resist the puncture action of high pressure discharges, as well as on the highly vitrified and homogeneous mass of the body throughout.

The illustration herewith shows in cross section a design of insulator intended to increase the breakdown voltage by the use of several layers of glaze between the pin and the wire. The insulator shown is a triple petticoat style, the three petticoats being the rims of three separate pieces of clay.



Multiple Glazed Insulator.

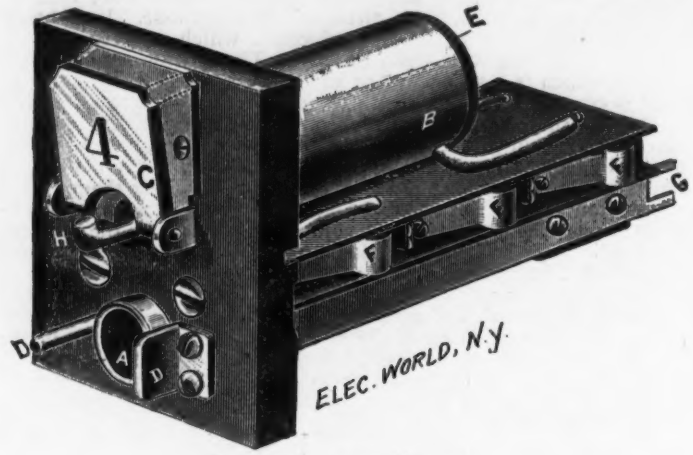
These are made to fit into each other nest-like, and are fitted with suitable centring projections and recesses to assure a co-axial mounting of the group. The separately moulded parts, after being pressed, are separately dried out by the usual process known as "biscuit firing." When ready to be put into the vitrifying kiln they are each dipped into and thereby coated with a glazing material, and then fitted into each other and placed upside down. More glazing material is then filled into the annular channels between the petticoats, after which they are vitrified as usual, the clay shrinking and the glazing material melting and filling the spaces left by the shrinkage. This renders the whole insulator a solid mass of highly resisting material, with internally protected layers of glaze that effectually bar out any leakage discharges that may occur, even if the outer glazed surface is chipped or broken by rough treatment or accident.

A patent was issued on details of the construction of such insulators on March 8, 1898, to Mr. John W. Boch, general manager of the porcelain works of the R. Thomas & Sons Company, East Liverpool, Ohio.

A Simple Telephone Switchboard.

A non-infringing switchboard with a minimum number of parts and the greatest simplicity in operation is manufactured by the Graham Electric Company, Rialto Building, Chicago. The board is, of course, made up for either grounded circuits, common return or all metal circuits, boards built for the latter service being obviously available for the other two. The jacks and drops are mounted together, each complete with its own magnet in a miniature panel, which can be entirely removed without disturbing the rest of the board. Such a panel with the attachments is shown in the illustration.

The most interesting feature of this board is the method of doing away entirely with ringing and listening switches, levers, push buttons and clearing out drops. This is accomplished by making the plug itself in such a way that all proper ringing and listening connections can be made, the clearing out being effected through the regular drops. As may be seen in the diagram the plug is fitted with two lateral studs, which, when turned in a horizontal plane, touch the listening terminals of the operator's set, as shown in the plug inserted in No. 5. By pushing the plug in hard, as shown in No. 3, the ringing



Jack, Drop and Magnet.

terminals are forced out against the line and the subscriber is thus called. On removing the hand from the plug it is pushed out, restoring the through connection.

A still simpler board is made for common return or ground circuits, the

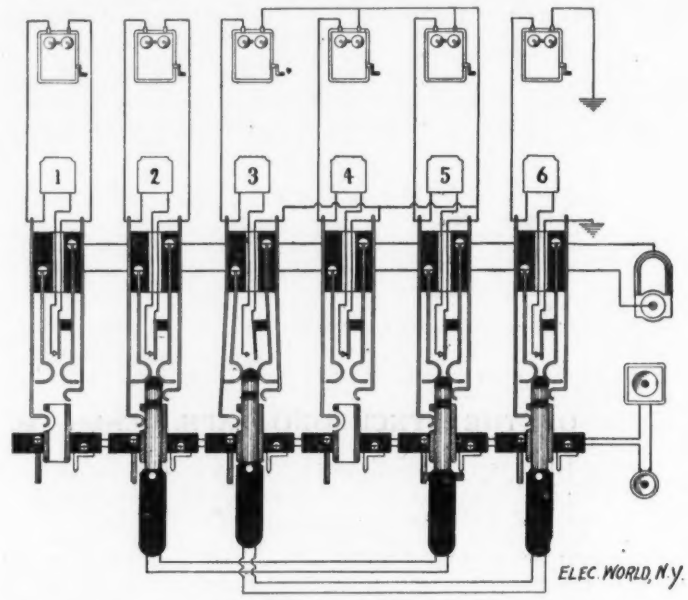


Diagram of Circuits

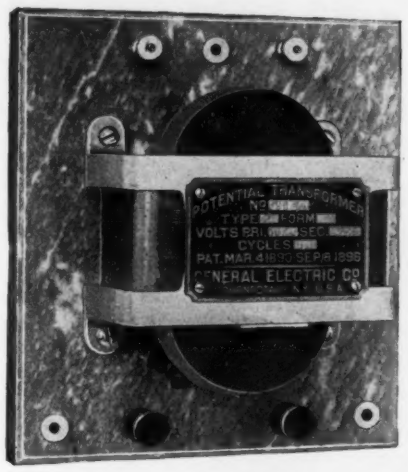
jack itself being made flexible, so that by pressing it in one direction by means of the plug it makes a listening contact, and in the other direction a ringing contact.

New Potential Transformers.

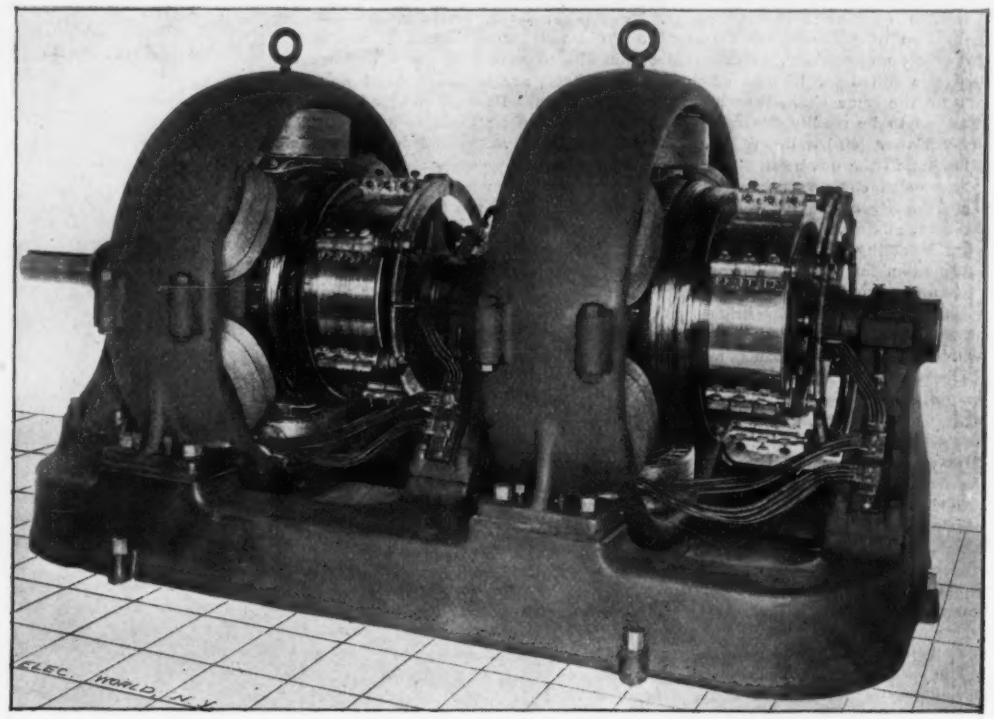
Potential transformers are designed to furnish current for either voltmeters of wattmeters. In common with other manufacturers, the General Electric Company has heretofore mounted its smallest standard lighting transformer on a slate or marble base, and supplied it to furnish current for instruments without changing its rating as a lighting transformer. It was thus allowable to load the transformer up to its full rated capacity with lamps and instruments. Since the ratio of transformation of a small lighting transformer varies some 2½ to 3 per cent., whether the lamps are burning or not, this practice is open to serious objection. The defect is doubly objectionable now that instruments of far greater accuracy than formerly are made. The absurdity of producing instruments accurate within 1 per cent., when the error is to be increased to 3 per cent. or more by using them in connection with a transformer with a variable ratio of transformation, is quite obvious. Potential transformers are not of sufficient output to load with lights, and they give the correct ratio of transformation at their rated output instead of at no load, as is the case with all other transformers. The rating assigned them is ten watts, which is ample to supply one General Electric inclined coil voltmeter and one single-phase recording wattmeter. They can be safely loaded to fifty or sixty watts for a few minutes, and are thus adapted to furnish current to phasing lamps in circuit long enough to synchronize the machines to which they are connected.

To meet various conditions the General Electric Company has designed five different potential transformers. The first, wound for 1040 volts primary and 52 volts secondary, for frequencies 60 to 125 cycles, is intended for use on circuits the voltage of which does not exceed 1250 volts, to supply current to indicating voltmeters reading to 75 volts and to primary recording wattmeters. The second, wound for 1040, or 2080 volts primary and 52 or 104 volts secondary, for frequencies of 60 to 125 cycles, furnishes current for indicating voltmeters reading to 75 or 150 volts, and is so wound that coupling the coils differently for use on different voltages is unnecessary. It has ample carrying capacity in the windings to give its full output on the lower voltages when only one-half of the winding is in use. Three primary and three secondary terminals are provided. If the transformer is used on 2080-volt circuits, the two outside primary terminals are connected to the line. If, however, it is used on 1040-volt circuits, the middle terminal and either outside terminal are connected to the line. By making similar connections on the secondary side either 52 or 104 volts can be obtained. The third, wound for either 1040 or 2080 volts primary and 57½ or 115 volts secondary, for frequencies of 60 to 125 cycles, is identical in its construction and use with the second, except that it is wound for stations using a ratio of transformation of 1 to 9 or 1 to 18 in place of 1 to 10 or 1 to 20. The fourth is so designed that it can be wound for any primary voltage up to 6000 volts, and any secondary voltage up to 115 volts, for frequencies between 60 and 125 cycles. As parts of this transformer are kept in stock, it can be wound on short notice. The fifth is similar to that just described, but slightly larger. It can be wound for the same voltages, but has a range of frequency from 25 to 60 cycles.

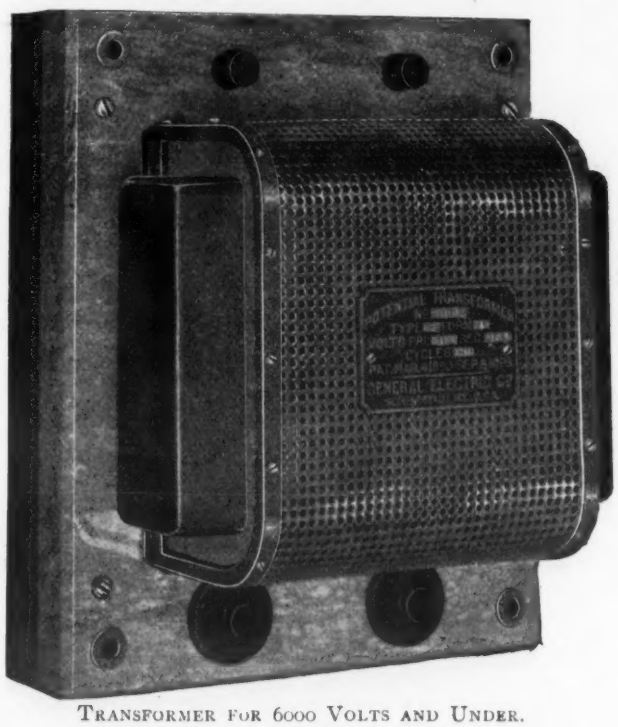
These transformers are designed to supersede all station and meter transformers which have been built by the General Electric Company up to the present time.



TRANSFORMER FOR 1350 VOLTS AND UNDER.



SPECIAL GENERATOR FOR THREE-WIRE SYSTEM.



TRANSFORMER FOR 6000 VOLTS AND UNDER.

A Special Generator.

The accompanying illustration represents a special generator of 150-kw capacity, just designed and built by the American Engine Company, Bound Brook, N. J., for the Crookston Water Works at Crookston, Minn., where it will be driven by a turbine shaft through a friction clutch coupling, running at 300 r. p. m., and used for supplying direct current to a three-wire system.

This machine is required to run at very low temperature and without any brush movement, and has been designed to meet the most exacting requirements.

Arc Lamp Hanger.

To meet the demand for an efficient, reliable and superior support and insulator for high tension arc lamps, the H. W. Johns Manufacturing Company, New York City, has placed on sale the "H. W. J." arc-lamp hanger, illustrated herewith. This hanger, with modifications as to the method of attachment for the lamp or suspending cable has been in use for some time, and has proved its ability to answer the purpose for which it was designed. An arc lamp hanger to be safe and satisfactory must maintain its insulating qualities under all conditions of weather; must possess ample strength to support the lamp under the strains contingent upon hard service and handling without risk of the lamp falling (the strength of the "H. W. J." hanger is 2000 pounds), must be readily attachable and detachable from the lamp, as required, and must be practically indestructible. The "H. W. J." hanger is said to fulfill these requirements. The interior construction of the hanger, which guarantees its strength and the integrity of its insulation, is illustrated in the sectional view. The arrangement of the parts is similar to that

ARC LAMP HANGER.

in the Giant strain insulators, furnished by the Johns Company for trolley line insulation. Sheet mica furnishes the insulation for the metal parts supporting the strains; the interstices and the outside covering are filled in and waterproofed with moulded mica.

Samples tested in water broke down at 7000 volts, and exhibited no signs of deterioration or danger when subjected, dry, to 15,000 volts. The "H. W. J." hanger is also furnished with snap hook for engagement with eye in lamp top, and with other means for attaching the suspending rope or galvanized cable. Many of the insulators are already in use.

A Twin Impulse Wheel.

The accompanying illustration shows a wheel recently constructed by the American Impulse Wheel Company, New York, for a textile goods factory in a town near Bordeaux, France. To avoid the inconvenience of arranging two jets on one wheel, in order to obtain the necessary power with buckets of a size suited for highest efficiency, two wheels are used, mounted side by side on the same shaft, thus allowing the two nozzles to be arranged side by side and to be readily controlled by the one governing shaft, which is shown in the lower left-hand part of the illustration, with a sprocket wheel for attachment to the governor.

The speed control is effected by the contracting nozzle plan, whereby the same velocity of the jet is maintained at all loads, and the flow is reduced as the load falls off, thereby obtaining a far higher efficiency than can be effected with deflecting nozzles or hoods, with which as much water is used on low lands as on full load. This method of control is also better than any method depending on gates or valves back of the orifice, since, with the latter arrangement, at low loads throttling of the steam reduces the velocity of the jet from the proper value of a little over twice the bucket velocity to values at which the efficiency is much lower.

The wheel shaft of this particular machine is mounted in three bearings supported on cast-iron standards, all outside of the wheel case. The two wheels are underhung between two of these bearings, and the pulleys for the driven belt between the middle and the third bearing. The wheel case is built up of steel plates riveted together with rolled shapes, the main gates for the two entering streams being bolted direct to the case. A hand hole is also provided on the end of the case to provide easy access to the nozzles and nozzle contracting mechanism without lifting off the upper half of the case which, in the illustration, is removed. This shows the buckets bolted to the wheel rims, their shape being that peculiar to the machines of the American Impulse Wheel Company, and designed to give the least spattering of the water and to throw the water from the buckets with the least absolute motion, whereby the greatest amount of power in the jet is absorbed in the wheel and the efficiency is rendered very high.

The wheels are 36 inches in diameter and designed to run at 285 r. p. m., developing 40 horse-power under a head of 126 feet.

Some 1898 Fan Motors.

The Western Electric Company's desk, bracket and ceiling fan motors are made for 110, 220 and 550 volts, and are so designed that on a 500-volt circuit three 110-volt motors or two 220-volt motors may be operated in series with perfect safety to the motors, and the 500-volt motor can be operated on a 600-volt circuit continuously without injury. All of these motors are wound for three speeds, and are made with self-oiling and self-aligning bearings.

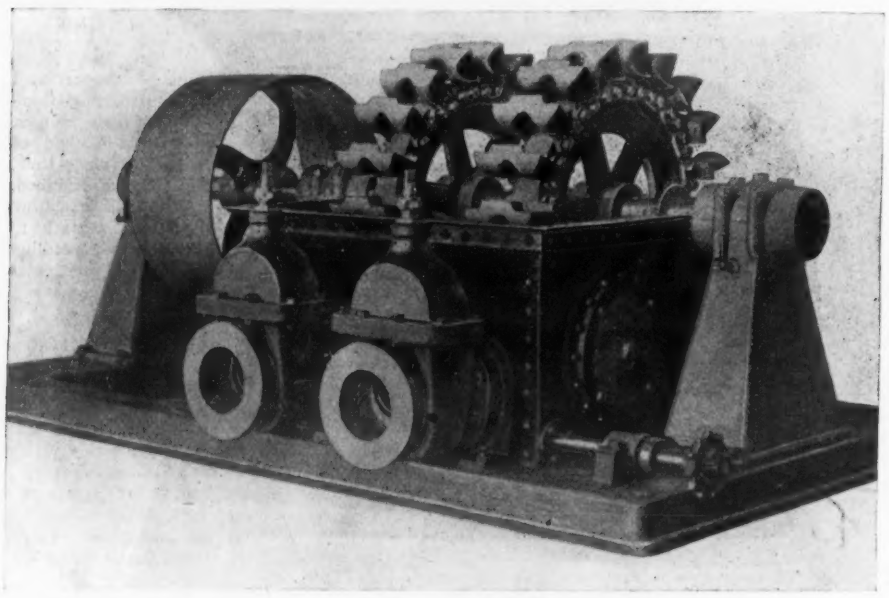
On the desk and bracket motors the switch is placed in the base, whereas in the ceiling fans it is placed in a neat switch box on the under side of the motor casing. The desk and bracket motors are made in two sizes, the sweep of the blades measuring 12 and 16 inches. The current consumption of the 12-inch motors is said to be much less than that of any 16-cp incandescent lamp on the market, while the current consumption of the 16-inch motors is but a trifle more than that required for the ordinary 16-cp lamp. The energy required by the 220 and 550 volt motors is practically the same as that required for the 110-volt motors. One very desirable feature is the facility with which the motors can be disconnected from the base and inserted in the bracket. These motors are finished in polished brass, nickel plate or black enamel without additional charge.

All ceiling fans are so made that chandelier attachments can be readily put on, every motor being wired ready for the sockets, the lead wires being coiled in the top of the switch box when not in service. The standard fan runs at 175 and 185 r. p. m. All motors are furnished with self-oiling and self-aligning bearings, and are perfectly balanced.

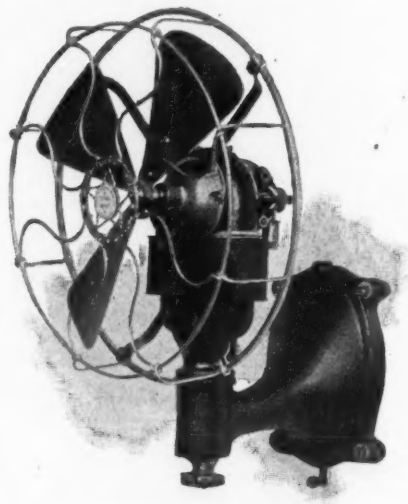
Ceiling Fan with Chandelier Attachments.

The column fans have but two speeds, 150 and 175 r. p. m., and are made with or without polished red birch tables, all metal work being finished in polished brass or oxidized copper. The motors are furnished with a switch, while the lights are controlled by a switch placed on the under side of the table. The tables can be furnished either square or round, and are 4 feet in diameter.

Special attention is called to the Tuerk alternating current fan motor, which is furnished with two blades, and is designed to be operated on a current of 60, 125 or 140 cycles, at 52 or 104 volts. This motor will be furnished, finished in bronze, Bower-Barff, nickel, brass or white and gold. All shafts are mounted on self-oiling bearings. By a very ingenious device the angle of the blades may be so changed that the wind may be blown downward toward the floor or upward toward the ceiling. The motors are of the reduction type. A reduction in speed is obtained by the introduction of leather-faced friction wheels by means of which the blades are rotated at a slower speed than that of the armature. This device enables the use of a highly efficient, high speed, alternating current motor, obtaining all of the desired results of the slow speed fan.



Twin Impulse Wheel.



Bracket Fan Motor.

News of the Week

Financial Intelligence.

THE AMERICAN BELL TELEPHONE COMPANY has declared its regular quarterly dividend of $3 per share, payable April 15.

THE ANNUAL MEETING of the American Bell Telephone Company will be held in Boston, on March 29. The directors will hold a meeting in the meantime to consider the annual report, which, it is said, will make a good showing.

THE EDISON ELECTRIC ILLUMINATING COMPANY of New York reports gross receipts for the month of February of $256,880, an increase of $44,076, as compared with the gross receipts in February, 1897. The net receipts were $117,073, an increase of $11,065.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, March 22, 1898.

MR. W. McLEA WALBANK, managing director, and Mr. R. S. Kelsch, general superintendent of the Lachine Rapids Hydraulic & Land Company, visited New York last week, to purchase apparatus for the new equipment of the company's sub-stations in Montreal.

THE AMERICAN TELEPHONE COMPANY, which occupies Rooms 902 and 903 in the new Townsend Building, Broadway and Twenty-fifth Street, New York, has just been established to do, it is said, a local telephone business in this section in opposition to the licensees of the American Bell.

LAMENT OF SALOON KEEPERS.—It is stated that the saloon keepers in the neighborhood of the bridge plaza in Brooklyn complain of a falling off in their business since the electric cars began running over the bridge. The former patrons of these places now pass right by on the cars on their way from home to business and vice versa. Before the new order of things went into effect the change from the surface cars to the bridge and from the bridge to the surface offered an irresistible opportunity to many men to tarry on the way.

A PUBLIC CELEBRATION of the new city charter will take place on May 4 and continue for three days. The decoration committee has planned a number of novel effects in electric illuminations, and has secured the assistance of several electrical engineers to carry out their plans. It is proposed to arrange searchlights in manholes along Broadway in such a manner as to project their rays of light upwardly. The lights will be so arranged as to produce novel and interesting effects. There will be similar displays along important thoroughfares in Brooklyn and in the other boroughs. Prizes will be given for street illuminations and house decorations, and "electric balloons" will be used to add to the attractions.

EARLY IN MARCH a special messenger of the firm of Baker & Co., the platinum refiners, of Newark, N. J., left a package of platinum tooth rivets on a seat in a Third Avenue Elevated Railway car. The moment he stepped from the train he thought of the rivets and rushed back for them, but he was too late; somebody had picked them up and disappeared. About a week later a stranger came into the firm's office on Liberty Street, in this city, and offered some rivets for sale. The man said his father, a junk dealer, had a lot more for sale. He was told to get them, and was followed by several persons from the office. The result was that the detectives who had been put on the case recovered all of the lost goods, which were worth $2,000. The junkman said he bought the rivets from a stranger, paying $1.50 for them. Mr. C. O. Baker, Jr., did some excellent detective work on the case, and it was due largely to his skill and sagacity that the lost property was so successfully recovered.

PROPOSED NEW RAPID TRANSIT COMMISSION.—A bill was introduced in the State Senate at Albany on March 14, providing for a new Rapid Transit Commission for New York City, to take the place of the present commission, which the bill, if enacted, will abolish. The new commission is to be appointed by the mayor of New York City. It is to consist of four capable, experienced and disinterested persons, two of whom shall be Republicans and two Democrats. They can be removed only for cause. Vacancies may be filled by a majority vote of the board Any act which requires the concurrence of six members of the present board may be done by a majority of the new board. The old board is to cease to be rapid transit commissioners upon the passage of the bill. Upon the organization of the new board the old commissioners are to deliver to it all furniture, books, maps, records, plans and other papers and property in their custody or possession. Compensation is provided for as for the present commission.

THE TELEPHONE RATE BILL.—An Albany dispatch states that the Senate Finance Committee has decided to report a substitute for the Brush bill reducing and regulating telephone rates throughout the State. The substitute, it is stated, is radically different in all its provisions from the original bill. In Senator Brush's bill the limit of charges in each city was specified, while in the substitute it is only required that the charges shall be "just and reasonable." Under the original bill a special commission was created to regulate the telephone charges and enforce compliance with the act. This bill places the matter under the supervision of the Railroad Commissioners and invests them with authority to investigate all complaints. The Citizens' Union held a meeting in this city on the evening of March 16 to consider the proposed measure. Resolutions were adopted calling upon all organizations and citizens interested in good government to co-operate in an effort to prevent the enactment of the bill on the ground that it would place the rapid transit enterprise in the control of political machines. The appointment of a committee of fifty citizens was authorized to oppose the measure before the Legislature.

THE ELECTRICAL EXHIBITION.—Mr. Fred Catlin, the manager of the telegraphic tournament to be held in connection with the electrical exhibition in this city next May, has completed the preliminary arrangements for that contest, and has arranged the classes. He states that the entries will probably be more numerous than at any other previous tournament. Mr. Jesse H. Bunnell, of the firm of J. H. Bunnell & Co., is a veteran operator, and he has volunteered to equip the stage with the necessary telegraphic apparatus for use in connection with the contest. Mr. H. V. Parsell, the banker, of this city, who has long been interested in electric deposition work, has placed in the hands of his son, Mr. H. V. Parsell, Jr., for exhibition, a large collection of galvano-plastic work done during a long series of years. It will not only include several striking pieces, as large as 25 x 25 inches, but will also comprise a large number of coins, medals and facsimiles of antique gems. Among the curious relics to be exhibited at the show will be the remains of two eagles and other birds that met an untimely end by perching upon and causing a short circuit between high frequency power transmission circuits in California. It is proposed to have also, among other railway apparatus, a working model of track to demonstrate the operation of the third-rail system as applied to steam railways. Col. N. H. Heft, electrical engineer of the New York, New Haven & Hartford Railroad Company, has placed at the disposal of the management blue prints showing the construction of the track and samples of actual material used. The model track, which will be 50 to 100 feet long and about 5 inches gauge, is now being constructed, and will be shown in actual operation during the exhibition, the details of the actual track being imitated as closely as the conditions will allow.

ONE MORE LINE of the underground trolley system of the Metropolitan Street Railway Company of this city has been put in operation, this being the Fifty-ninth Street crosstown line, serving as a general transfer between the main lines running north and south. The cars of the Amsterdam Avenue line, which previously ran down only to Sixty-fourth Street, now run from that point on the cable tracks of the Columbus Avenue line. Their plows run into the cable conduit, in which, however, there are no conductors, and they are, therefore, necessarily pushed over the road to Fifty-ninth Street by the cable cars, at which point they again take up their own power. The Metropolitan Company some time ago opened these tracks and started putting in double conduit yokes. The main cable conduit (deep and narrow) was placed midway between the two rails, and a shallower and broader conduit for the electric rails was offset to one side. Difficulties arose, however, with the Ninth Avenue Railroad Company, the tracks of which the Metropolitan Company is only using by lease, and the work was stopped. The cars will be pushed temporarily until this difficulty can be overcome. The electric cars, of course, run dark in the evening over this section of the road, a rather unusual feature of electric car service. The construction of the switches and crossovers at both Fifty-ninth Street and Sixty-fourth Street has brought up problems of considerable difficulty, as the complicated underground work had to be done without interrupting the continuous running of the cable underneath or the cars over the surface. For many months the work has been carried on at these points both day and night, a great number of gasoline flares illuminating the streets during the early part of the work, supplemented during the latter part of the work by groups of incandescent lamps in series of five across the underground mains and hung in festoons from the structure of the elevated railroad overhead.

COMMUNICATIONS BETWEEN THE FORTIFICATIONS OF NEW YORK HARBOR are to be provided at once under the direction of the signal officers of the War Department. The headquarters of the War Department in New York City, in case of hostile action, would be on Governor's Island, situated in the upper bay, between the tip of Manhattan Island and Brooklyn. This island is now connected both with the shore of Manhattan Island and also with Brooklyn by cables carrying several conductors, and via the lines of the commercial telephone and telegraph companies with the various other fortifications of the harbor. Each such point has both a telephone and telegraph service via different routes, partly underground and partly overhead. To provide still further alternative means of communication a submarine cable will be laid from Governor's Island to the forts at the Narrows and thence to Sandy Hook. Bids for this will probably be advertised for before this paper reaches its readers, as the work is being hurried on account of the present international difficulties. The cable will carry one twisted pair of conductors, insulated probably with rubber and iron armored with eighteen strands of No. 9 B. W. G. iron wire. This cable will be about 20 miles in length. At either Fort Wadsworth or Fort Hamilton the cable will be landed, and a three-pair cable will be laid across the Narrows to the other fort. The fortifications at Davids Island, Fort Schuyler and Willetts Point, protecting New York from hostile ships approaching by the sound, will not be connected with Governor's Island by a submarine cable, as has been reported in the daily press. The land routes from these points are so far inland and so well protected that it is considered unnecessary to provide submarine alternatives. A short length of three-pair cable will, however, be laid across from Willetts Point to Fort Schuyler, and also from the latter point to Fort Slocum on Davids Island, thus giving those

points short intercommunicating lines and several more alternative routes to the headquarters on Governor's Island. A cable laid some time since by the Safety Insulated Wire & Cable Company between Governor's Island and Ellis

Map Showing Routes of Cables.

Island, for the use of the immigration authorities, has been so cut and twisted by the anchoring of ships that it was necessary to take it up. It has now been repaired and is ready to be relaid.

THE RAPID TRANSIT COMMISSION at its meeting on March 19 received the report of the committee on contract, giving a statement of the plans drafted for the extension of the elevated railway system in this city, together with the proposed terms for the franchises. Seven franchises are offered. The first is for the construction of two additional tracks from the City Hall, along Park Row and the Bowery to Fifth Street. For this franchise the committee proposes an original rental of 2 per cent. of the increase of the gross receipts of the stations between City Hall and Fifth Street. If work is not completed within two years, rentals shall begin at the rate of $100 a day until the road is completed. The second franchise calls for the construction of a continuous third track from Fifth Street to 129th Street, along Third Avenue. For this franchise an original rental of 2 per cent. on the increase of gross receipts is proposed, the construction to be completed within one year, rent to begin at the rate of $100 a day after that time. The third franchise contemplates the northern extension of the East Side line to Bedford Park. The original rental for this franchise shall be 5 per cent. upon the gross recipts, rental to begin at the expiration of two years at the rate of $50 a day. The fourth franchise provides for the construction of a continuous third rail on the Ninth and Eighth Avenue lines from Rector Street to 155th Street. The rental for this is 2 per cent. of the increase over the gross receipts for 1897 of the stations between Rector Street and 155th Street inclusive. The work is to be finished in one year, and the rental is to be $100 a day. A penalty of $100 a day will be exacted if the lines are not built within the specified time. The fifth franchise provides for the construction of the West Street and ferry connecting route, as proposed by the Manhattan Company, modified, however, so as to require the inclusion therein of a loop at Battery Place with the Sixth and Ninth Avenue lines, and an overhead crossing of the existing Ninth Avenue line at Horatio or Gansevoort Street by the new line. The rental for this franchise is 5 per cent. of the gross receipts, and the construction work must be completed within three years under a penalty of $200 a day. The sixth franchise provides for the construction of the City Hall branch along Centre or Canal Streets, as proposed by the Manhattan Railway Company, except that the route shall be slightly changed in order to make direct connection with the Desbrosses Street ferry. The rental for this franchise is 5 per cent. of the gross receipts of all stations, including the new station at City Hall. The work must be completed in three years under a penalty of $150 a day. The seventh franchise provides for a route beginning at Ninth Avenue and Fifty-third Street, connecting with existing lines and proceeding thence along West Fifty-third Street to Tenth Avenue, along Tenth Avenue to Fifty-sixth Street, thence by tunnel under Tenth Avenue to a point between Fort George and Dyckman Street, and thence along Tenth Avenue and Kingsbridge Road to Kingsbridge. The Manhattan Company has the option to construct a viaduct over the Manhattan Valley instead of a tunnel beneath the same. The tunnel should be sufficiently deep to allow another tunnel to be built over it at the intersection of Tenth Avenue and the Boulevard, and also to allow of a substantially level track from Fifty-sixth Street to Dyckman Street. The rental of this franchise is fixed at 1 per cent. of the gross receipts during the first year, 2 per cent. during the second year, 3 per cent. the third, 4 per cent. the fourth and 5 per cent. thereafter. The time limit to Dyckman Street is three years, and to Kingsbridge two years more, the penalty being $250 a day. It is proposed that the Manhattan Company shall be permitted to accept any or all of these franchises. The report was adopted and certificates authorizing the improvements will be submitted at the next meeting of the board, which will be held to-day. At the same meeting it was resolved to accept the modified requirement of the Appellate Division of the Supreme Court about the contractor's bond, and to go ahead and prepare to advertise for bids for building and operating the proposed underground road.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Build'ng, 620 Atlantic Ave.,
Boston, Mass., March 21, 1898.

THE NEW ENGLAND ELECTRIC TRADES ASSOCIATION held its regular meeting and dinner at Young's Hotel, March 18, twelve members being present, and an enjoyable time was experienced. The principal business discussed was the formation of a national electric trades association, and it was the sense of the meeting that it was advisable that a national association be immediately organized.

THE BOSTON AUTOMATIC FIRE-ALARM COMPANY is now located in handsome new offices at 111 Milk Street. The new offices were formally opened on March 16, Manager Charles Burgher giving a reception that was largely attended by persons interested in the automatic fire-alarm systems of the city of Boston, and a large representation from the insurance and business interests. The new offices are equipped with every modern appliance for giving an alarm in case of fire, and everybody had a chance to see how nearly perfect was the apparatus of this company. The devices for receiving and sending alarms showed the results of long and careful study, and the central station equipment, in fact the entire plant appears to be up to date in every detail. The insurance representatives present were particularly interested in the new plant. The reception was in every way a success. Manager Burgher did not try to give a definition of electricity to his many friends, but he did convince everybody that he knew how to handle the "subtle fluid." Among those present were Capt. William Brophy, Wire Commissioner Flood, Frank Ridlon and Mr. E. S. Cowles, of New York.

THE NATIONAL TELEPHONE MANUFACTURING COMPANY, Boston, announces what is declared to be an important contribution to telephony in its new "selective" system. This system is of especial interest to owners or managers of telephone toll lines, steam and electric roads, corporations and the public generally. The construction of a metallic or ground circuit with an indefinite number of telephones connected has long been a problem, which prominent experts say the National Company has solved. This new system emphasizes the fact that every hamlet or village throughout the country can be reached by telephone at a trifling cost, thus doing away with small exchanges where switchboards are too expensive. It is claimed that lines may be constructed from any switchboard connecting an indefinite number of subscribers, and through the application of this new system the operator can ring and talk with any subscriber upon the same circuit or connect subscribers with any other line or circuit without disturbing other subscribers, and no other subscribers can listen in. If there are two switchboards in different communities either operator can do the same work with subscribers upon the connecting lines or connect them with subscribers upon other lines. This is termed a double system. The National Company guarantees its system to be free from complications, and states that it is simplicity itself. It can be attached to any switchboard or telephones of other makes.

Philadelphia Notes.

Branch Office of The Electrical World,
929 Chestnut Street,
Philadelphia, Pa., March 21, 1898.

MR. JULES VIENNOT, a well-known advertising agent in Philadelphia, died at his home in this city on March 11, at the age of seventy-three years. Mr. Viennot was born in Paris, and came to this country about forty years ago. He was an officer of the French Academy, the honor having been bestowed upon him by the French Government. He conducted a large advertising business, and handled the advertising of some of the most prominent electrical concerns.

THE PHILADELPHIA ELECTRICAL EXPOSITION COMPANY will given an electrical exhibition in its building, 818 and 820 Chestnut Street, for one month beginning June 6, 1898. No exhibition has been given in Philadelphia since 1884, and public interest will be aroused by a systematized attempt to place before it all the progress of electricity since that time. Especial efforts have been made to interest distinguished inventors such as Edison, Telsa, D. Macfarlan Moore, Elihu Thomson, Steinmetz and many others. While the exhibition will necessarily be commercial, no pains will be spared to make it of the highest scientific character and instructiveness. Much thought and time will be given to tasteful decorations, and the best of music will be furnished. Many of the exhibits will be such as have never been brought before the public up to this day. The kinetoscope will be employed for a series of moving pictures of military and naval subjects of peculiar interest at the present moment. Extraordinary pains will be taken to have phonograph addresses from distinguished men delivered at stated hours. The management has obtained the services of Prof. William D. Marks as director. Professor Marks' former experience as manager of the Franklin Institute Exhibition and his intimate knowledge of the progress in electricity will be a guarantee that nothing of interest in the lastest advances of scientific discovery will be omitted.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., March 19, 1898.

THE BUFFALO, HAMBURG & AURORA trolley company did not open bids for the construction of its line this week, as was expected, but deferred to the requests of about a dozen contractors, who asked more time to consider the proposals. The bids will be opened on March 30, when a proposition to double the capital stock will be voted on.

THERE IS A PROJECT on foot to connect Buffalo and Lockport, about 30 miles distant from each other, with a trolley line, which will be an extension of the Buffalo Traction Company's line from Buffalo to Tonawanda. As the plan is to use the tracks of the Erie Railroad between Tonawanda and Lockport the move is a distinct advance in trolley development, at least in this vicinity. It is reported unofficially that a fifty-year lease has been given of the right of way over the road.

A MEETING of trolley line promoters was held at Springville on March 16 for the purpose of extending the Hamburg line to that town from Buffalo, but it was thought best, after looking the ground over, to proceed toward Gowanda instead, and it was accordingly agreed to build a line to Norton's Corners for the present, a distance of 16 miles, with the intention of finishing to Gowanda in time. This route was selected in part on account of the opportunity of utilizing the falls of the Cattaraugus for the generation of power. A preliminary survey has already begun.

THERE IS A PROPOSITION AFOOT to develop the manufacturing capabilities of the Niagara power line between the tunnel and Buffalo by enlisting the co-operation of the Smith trolley company, which runs closest to the line between Buffalo and Tonawanda. The plan is to build cars suitable for carrying freight in either large or small quantities, and deliver it to the steam roads at a nominal charge. A switch to any factory on the line saves the manufacturer the cost of providing a cartage system of his own, while at the same time the service will be of the best.

THE INCORPORATION IS ANNOUNCED of the Buffalo Valley Railroad Company, which is to build a trolley line from the end of the city lines on Clinton Street to Java in Wyoming County, a distance of 27 miles. The road will tap a good district and run either through or close to several villages. The plan is largely to carry market produce and other freight and express matter. The capital is $350,000, a majority of it being held by the Pennsylvania Steel Company, at Steelton, Pa. There are also good local men in the company, as, for instance, George A. and C. W. Ricker, the engineers, who have already made a preliminary survey of the route. Work is to begin as soon as the right of way is secured.

CHICAGO NOTE.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., March 19. 1898.

THE COMMITTEE of the Northwestern Electrical Association having in charge the duty of making arrangements for the summer convention of that association held a meeting at Janesville, Wis., on March 14. Messrs. P. Norcross, chairman; P. H. Korst, Henry L. Doherty and J. M. Hill were present. A resolution was passed accepting the invitation of the cities of Duluth and Superior, extended to the association to visit those places next June. Mr. J. M. Hill, of Chicago, was authorized by the committee to charter a steamer from any steamboat company, on which to hold the summer meeting of the association en route from Chicago to Duluth, via Sault Ste. Marie, Hancock and Houghton.

ST. LOUIS NOTES.

ST. LOUIS, March 18, 1898.

A BILL FOR 75 CENTS is causing trouble in settling the affairs of the International Electric Company. All the creditors of the company have consented to set aside the assignment except one, who lives in England, and to whom the company owes 75 cents.

MR. C. A. COOPER, of St. Louis,, electrical manufacturers' agent, and representative of the K. & W. Company, Pittsfield, Mass., has returned from the Laredo convention. With him came the Mexican delegation, who are here for the purpose of buying machinery and supplies for their plants.

A SUIT has been brought by George H. Little against the Chicago & St. Louis Electric Railway Company. An investigation of the books of the company has been asked for, and the mandamus ordering the production in the the Circuit Court of all the books and accounts of the company is returnable March 27.

ON THURSDAY AFTERNOON, March 10, the Olive branch electric plant at Ferguson, St. Louis, County, was sold at public sale by order of the Circuit Court of St. Louis County. Only three bidders were present, and Mrs. J. L. King, of St. Louis, got the property for $5,000. It is said by Gustave Wurdeman, receiver for the plant, that the sale would hardly be approved by the court. The construction of the plant cost about $32,000, and a $15,000 mortgage has been levied on the property.

A FRANCHISE was asked this week from the County Court at Clayton, by the St. Louis, Clayton & Creve Cœur Lake Railway Company to construct an electric railway with several branches in the county. The franchise asks for the privilege of building a road from the double track south of the Olive Street road at Ferguson to the Meramec River. Two branches are proposed, one to run to Des Peres and the other to make a loop in the town of Clayton. The company promises a liberal system of transfers, and will run freight, ambulance and funeral trains. It is proposed to begin work within thirty days from the approval of the charter.

MEMBERS of the Board of Public Improvements, believing that the City Council in passing the Keyes conduit bill intended that all overhead telephone, telegraph and electric light wires should be removed in the subway district, filed applications from the various wire using companies for permits to erect poles and string wires in nearly all of the downtown alleys. About 150 such applications were disposed of. Three of the applications, two of the Kinloch and one of the Bell Telephone companies, were deferred until some future date.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., March 12, 1898.

THE LOSTINE TELEPHONE COMPANY, of Lostine, Ore., was recently incorporated by E. W. Rumble and others, with a capital stock of $1500.

THE CENTRAL LIGHT & POWER COMPANY, San Francisco, has decided to add to its central station equipment two 200-kw Siemens & Halske generators, directly connected to a Union Iron Works' vertical compound engine.

THE TOWN OF LEMATI, Ore., has levied no city tax for six years past, it is reported. The city water rate, of 75 cents a month per family, has paid for the city electric street lighting, built a city hall and paid interest on the city bonds.

THE YUBA POWER COMPANY, which will supply Marysville, Cal., and the Brown's Valley mining district with electric power, expects to have its water power generating station in operation during the present month. Work was commenced on the system November 11 last. Pelton water wheels are directly connected to Stanley generators.

THE FRESNO PLANT of the San Joaquin Power Company, which has supplied Fresno, Cal., with electric power generated on the north fork of the San Joaquin River, 36 miles from the town, has been connected with Hanford, Cal. Power will be transmitted the 67 miles from the generating station to Hanford at 19,000 volts. The owners claim to have the longest transmission line in existence to-day.

LIGHTSHIP NO. 70, which was recently completed by the Wolff & Zwicker Iron Works Company, Portland, Ore., has arrived in this city, and will soon be placed in commission 4½ miles off the heads, at the entrance to the Golden Gate. She will have a three-lens lantern extending around each of her two masts, with three 100-cp electric lights in each lantern. There are two generators; steam pressure, 100 pounds.

THE SAN GABRIEL TRACTION COMPANY has been incorporated by Chicago and Los Angeles capitalists, with a capitalization of $1,000,000, of which $22,000 has been subscribed. The directorate consists of James S. Graham and S. P. Anderson, of Chicago, and W. S. Maxwell, B. W. Lee and Albert Hadley, of Los Angeles, Cal. Nearly all of the subscribed shares were taken by James S. Graham. It is proposed to build a street railway line from Los Angeles to Pasadena, with a branch line to Alhambra, Sierra Madre, Monrovia and Duarte. The road will probably be 22 miles in length.

THE COMMERCIAL LIGHT & POWER WORKS, which has been in operation in this city for eleven years past, will soon be incorporated by the owners, I. L. Borden & Co., under the name of the Commercial Light & Power Company. The capital stock will be placed at $1,000,000. Realty on Battery Street was recently purchased, on which will soon be erected an additional electric station of modern design. Plans have been drawn and bids will soon be called for upon an ample two-story brick building and a steam and electric equipment in accordance with the best practice. The district east of Kearny Street and north of California Street has been partly supplied with electric lights and power heretofore, but the new station will enable the company to extend its operations to all parts of the city. The present system is of Stanley two-phase type.

CANADIAN NOTES.

MONTREAL, QUE , March 19, 1898.

ENGINEER LEYDEN, of the Cataract Power Company, has submitted to the city engineer of Hamilton, Ont., a proposition for running the sewage disposal works by electric power, but at present it is not known whether his scheme will be adopted.

THERE IS A GOOD DEAL of favorable criticism of the kindly action of the Royal Electric Company, of Montreal, in coming to the assistance of the Lachine Rapids Company, whose power house was burned during the first part of the present month. The Royal lighted Westmount and Mile End for its competitor without charge for several days.

THE ELECTRIC REDUCTION COMPANY, Buckingham, Que., has placed an order with the Canada Electric Company for a 1000-hp revolving field generator to be used for electrolytic work. The machine will be similar to those installed at Lachine, in the Province of Quebec, and also in West Kootenay, B. C., except that the current will be applied at the low potential of seventy-five volts.

THE TORONTO ELECTRIC MOTOR COMPANY and the Thomson Electric Company, Hamilton, have amalgamated, and the change took effect on March 15, under the name of the "Toronto Electric Motor Company, Limited." The Hamilton factory will be moved to Toronto, and will occupy new buildings, which the company is to furnish by May 1. The new shops will be of the most modern type, with traveling cranes, etc. With this change the new company will be in a position to do the heaviest work in power apparatus as well as in arc and incandescent of all kinds.

THE STANDARD LIGHT & POWER COMPANY has recently purchased the installation of the Temple Electric Company, of Montreal, consisting of a station equipped with Edison three-wire apparatus and a distributing system with considerable of an all-day load. The steam machinery of this station will be shut down, and power will be supplied from the hydraulic plant of the Lachine Rapids Hydraulic & Land Company, with which the Standard Light & Power Company is closely allied, thus giving the Lachine plant a greatly improved load factor. Two 150-kw Walker alternating current dynamos of the internal revolving field type have been purchased, and will be used as synchronous motors, belted to the line shaft of the recently purchased plant.

French Notes.

(From Our Own Correspondent.)

PARIS, March 4, 1898.

ELECTRICITY IN THE PROVINCES.—Of the numerous provincial cities which have adopted electric lighting there may be cited as among the most recent Châlons sur Saone, Châtel-Guyon, near Lyons, and Eu, celebrated for the castle of the late Comte de Paris. At Tours, Department of Indre et Loire, the Compagnie de Tramways, with a capital of $500,000, is about to make an installation, using the surface contact system of Diatto. The same company operates the old lines of the Compagnie Générale Francaise de Tramways with the same Diatto system, and the suburban lines to Luynes and Saint Avertin in the suburbs of Tours. M. de Brancion is the concessionaire of these lines.

THE GRAISIVANDAN VALLEY CENTRAL STATION.—One of the most important electric lighting installations in France has just been opened with great success in the beautiful Graisivandan Valley, near Grenoble, in the Department of Isere. This plant, which was installed by the Compagnie l'Eclairage Electrique, uses alternating currents, the transformers and generators being of the Labour system. The tension on the primary circuits is 12,000 volts. The lines radiate over more than 49 kilometres (30 miles), and serve fifty towns and villages. The generating station is at Lancey, and was installed in the Bergès paper mill. The reducing transformers, to the number of fifty, are placed on poles in each of the places served. This installation presents many features of great interest.

FOR THE EXPOSITION OF 1900 the Compagnie Générale Transatlantique of Havre, which, it will be remembered, showed a splendid panorama of its fleet at the exposition of 1889, is preparing a novel apparatus which is sure to have a great popular success. M. Eugene Pereire, the president of the company, and M. Joubert. have conceived the idea of combining, in gigantic proportions, the cinematograph and the Dussaud phonograph. This combination is to represent on a full scale the different scenes of maritime life, with all their activity. It is to show ships in motion, to reproduce the sounds of the waves and the wind, etc. The optical illusions of the cinematograph will be completed by the reproduction of the sounds of nature. The apparatus consists of a cinematograph especially built for this purpose and driven by an electric motor, its shaft being geared to twelve large and powerful phonographs. When the apparatus is making its record the cinematographs photographs the various scenes before it, while at the same time the phonographs record the different sounds and noises of all sorts going on in the neighborhood. When the machine is set to reproduce, the phonographs and the optical part are driven synchronously by the motor, the tubes of the phonographs being led to openings in the back of the chairs in which the spectators are seated. The effect is a reproduction of both sights and sounds in a very natural manner.

SOCIETE INTERNATIONALE DES ELECTRICIENS.—The regular monthly meeting of the society was held on March 2, M. d'Arsonval presiding. A new method of breaking electric currents, designed by M. Bouchet, and shown in several models, was presented by M. P. Janet, a brief description of this apparatus being as follows: In a box of insulating material, divided by a low wall into two separate chambers, there is placed sufficient mercury to fill the two chambers to a point somewhat below the top of the dividing wall. Two vertical rods are arranged to be plunged into these two chambers, their displacement raising the mercury to such an extent that it overflows the wall and makes a complete circuit between the two rods which are connected by flexible cables to the circuit terminals. When the rods are raised the circuit is broken at these points, namely, between the rods and the surface of the mercury in the two chambers and between the two bodies of mercury falling below the dividing wall. Practical tests of this apparatus showed that circuits could be broken without a trace of arcing. Apparatus with three rods, three chambers and two dividing walls has been tried in a circuit of twelve amperes at 3000 volts. By arranging an electromagnet to operate the rising and falling rods a magnetic circuit breaker can be obtained. M. Barbarat then made some remarks on the employment of underground cables with air insulation in the telephone conduit systems at Paris in place of cables insulated with gutta-percha, which have been employed hitherto. The telephone management is now using cables, the conductors of which are separated by paper. The insulation is maintained at a high point by currents of air, which are blown from time to time through the cables, the extremities of which are connected by pipes with an air compressor placed at the centre of distribution. If the insulation of any cable falls it can be readily raised again by driving into the cable for a certain time dry compressed air. Trials have been made with cables both on the city and interurban lines up to a considerable distance, and have given in all cases very satisfactory results. M. Barbarat expressed the opinion that such cables could probably be employed to advantage in the distribution of electric power.

ELECTRIC TRAMWAYS IN PARIS AND ITS SUBURBS.—In the course of divers inquiries recently held by the General Council of the Department of the Seine upon the subject of tramways entering the city, M. de Brancion, author of a very important project for a departmental tramway system in the Department of the Seine (which practically means Paris and its suburbs), has prepared a report. After having analyzed all the rates of fares licensed by the city to the powerful Compagnie Générale des Omnibus, M. de Brancion demonstrates that the use of electricity has recently much reduced the cost of traction, and proposes actually, in principle, that if the Department of the Seine and the city of Paris, with their density of population, with the incomparable activity of its circulation within them at all hours, wish for them they can have all the tramway lines they need or could use, operating a single class system at the fixed price of 10 centimes (2 cents) for the trip in any of the communes or even across Paris. More than this, the asking of a 15-centime (3-cent) fare would not be a hazardous experiment, but on the contrary would really be a step backward and an aggravation of the existing state of things. Actually, now, with the system of free transfers in vogue, a passenger can travel no less than 12 kilometres (7½ miles) for 30 centimes (6 cents). It is very important that in 1910, when the old franchises expire, the city should have the greatest freedom of action. At that date, with the probable total suppression of the fortifications, they should proceed to entirely overhaul the whole matter of the directions and routes of the various lines. M. de Brancion formulated his proposition in these terms: For all sections of lines which the arrangement of routes, of bridges or of gates of entry, made common to several lines of tramway, whether in Paris or in the Department of the Seine, concessions should not be exclusive, and all future concessionaires should have the power to claim free passage without tolls or charges of any kind over the common section, except that they should bear their proportional part of the costs of repairing and renewing the tracks and otherwise should share in the depreciation costs of the part of the roadway used jointly. Such a reservation, he continues, being the reverse of monopoly, should certainly be received with favor by the electors of the department, by the administration and by the commission of inquiry. If it is ever accepted it will be a victory for electricity. At Clamart the overhead trolley road project is progressing. The administrative term, which is only one year in length, may perhaps have a bearing upon a settlement of the matter. As soon as the formalities are ended work on the road will be immediately begun, and it is then to be hoped that the 3,000,000 passengers who alight at Clamart annually, going to and from Paris, will have the benefit of the electric road by June of this year. A project for electric lighting in this important suburban locality is also spoken of in connection with the railway. There should be numerous customers for a plant, since Clamart possesses an asylum founded by the Duchess of Galiera-Ferrari, a municipal hospital and the very large Ste. Philippe orphanage. These various establishments consume a very respectable amount of current in the course of a year.

Notes of the Laredo Convention.

THE LOWER FLOOR of the large building in which the convention was held was devoted to exhibits. There was a large number of interesting displays of electrical and other appliances, and they attracted much attention.

THE PARKER-RUSSELL COMPANY, St. Louis, Mo., was represented by Mr. Leigh Wickham.

THE WACO ELECTRIC SUPPLY & PLUMBING COMPANY'S exhibit was in charge of Mr. S. A. Hobson.

MR. C. W. COBB, of the Central Electric Company, Chicago, was on hand and did some good work for his house.

THE COMMERCIAL ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., was well represented by Mr. V. E. Raggio.

THE AUSTIN ELECTRIC SUPPLY COMPANY, Austin, Tex., had a representative in the person of Mr. J. E. Johnson.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., were represented by Mr. F. E. Donohoe, the Chicago representative.

THE K. & W. COMPANY, Pittsfield, Mass., was represented by Mr. C. A. Cooper, the general Western agent, whose headquarters are in St. Louis.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., was represented by Mr. H. C. Monroe, who, in addition to looking after the company's interests, took a leading part in the deliberations of the convention.

MR. FRANK H. CLARK, of Chicago, represented the Electric Storage Battery Company, of Philadelphia. Mr. Clark explained very thoroughly the good points of the chloride accumulator, and his remarks were listened to with very much interest by the visitors.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., had the largest exhibit of all. The company was represented by Mr. A. W. Dutton. Mr. R. V. Scudder, secretary and treasurer of the company, was also in attendance at the convention. He was accompanied by his wife.

THE ELECTRIC APPLIANCE COMPANY, Chicago, was represented by Mr. W. M. Brooke, who is well known to the electrical fraternity throughout the country. Mr. Brooke possesses rare qualities as an entertainer, and kept the delegates in good humor between the business sessions. Mr. W. W. Low was also in attendance.

General News.

New Incorporations.

THE TECUMSEH TELEPHONE COMPANY, Tecumseh, Mich., has been organized with a capital stock of $10,000.

THE FARMERS TELEPHONE COMPANY has been incorporated at Petersburg, Ill., with a capital stock of $5,000.

THE PRESTON LIGHT & WATER COMPANY, Preston, Ia., has been organized by Dr. H. Perkins, W. B. Davy, J. M. Gillette and others.

THE HARVEY LAKE ELECTRIC LIGHT, HEAT & POWER COMPANY, Wilkesbarre, Pa., has been incorporated with a capital stock of $1,000.

THE WELLAND AQUEDUCT POWER COMPANY, Welland, Ont., has been organized with a capital of $25,000 to supply electricity for light, heat and power.

THE SANFORD LIGHT & POWER COMPANY has been formed at Augusta, Me., with a capital stock of $100,000, for the purpose of furnishing light and power to Kennebunkport and adjacent towns.

THE WESTERN TELEPHONE MANUFACTURING COMPANY, Chicago, Ill., has been formed with a capital stock of $2000. The incorporators are M. B. Kennedy, W. A. Bisland and S. C. Platt.

THE INDIANA HEAT, LIGHT & POWER COMPANY, Mishawaka, Ind., has been incorporated with a capital stock of $250,000. The incorporators are H. H. Hosford, Archibald G. Graham and others.

THE ROCKFORD RAILWAY, LIGHT & POWER COMPANY, Rockford, Ill., has been incorporated with a capital stock of $250,000. The incorporators are F. A. Poor, N. B. Poor and R. S. Clements.

THE WEST VIRGINIA WESTERN TELEPHONE COMPANY, West Union, W. Va., has been formed with a capital stock of $75,000. The incorporators are J. H. Grogg, Joseph Freeman and A. H. Tutwright.

THE SOUTH MILWAUKEE ELECTRIC LIGHT COMPANY, South Milwaukee, Wis., has been formed with a capital stock of $15,000. The incorporators are William P. Cook, F. S. Pamperin and William Wiotte.

THE S. V. INTERIOR TELEPHONE COMPANY, New York City, N. Y., has been incorporated by R. G. Vassar, J. G. Smith, J. D. Anderson, W. B. Dall, C. C. Bean, G. S. Tait and C. A. Dall. Capital stock, $30,000.

THE CROOKSTON TELEPHONE COMPANY, Crookston, Minn., has been incorporated with a capital stock of $10,000, for the purpose of connecting Crookston, East Grand Forks, Red Lake Falls and other towns by telephone.

THE SILVER CITY ELECTRIC LIGHT COMPANY, Silver City, Idaho, has been incorporated with a capital stock of $6000. The directors are John Grete, Sr., John Tortiff, John Grete, Jr., Fred Grete, Jr., and George H. Handy.

THE AMERICAN ELECTRICAL NOVELTY & MANUFACTURING COMPANY, New York City, N. Y., has been formed with a capital stock of $25,000. The directors are Conrad Hubert, Maurice Hartman and Joseph Harwich.

THE STERLING ARC LAMP COMPANY, of the Borough of Manhattan, New York City, N. Y., has been incorporated with a capital stock of $100,000. The directors are Andrew Faulds, Jr., J. G. Galland, Paul Raff and Michael Wallstein, New York City.

THE HAMPSHIRE TELEPHONE COMPANY, Renney, W. Va., has been incorporated with a capital stock of $10,000. The company's intention is to build a telephone line which will connect Renney, Slanesville, Moorfield and Burlington, W. Va., and Winchester, Va.

THE ITHACA TELEPHONE COMPANY, Ithaca, Wis., has been incorporated to operate a telephone line from Neptune to Ithaca; also to Richland, Sextonville and Twin Bluffs. The officers are Abraham Lincoln, president; C. A. Matthews, secretary; C. F. Marden, treasurer.

THE INTERSTATE TELEPHONE COMPANY has been organized at La Crosse, Wis., with a capital stock of $100,000. The incorporators are P. S. Elwell, George W. Bunge and Andrew Lees. It is said that the company will be identified with independent telephone interests.

THE CALUMET TELEPHONE COMPANY, Fond du Lac, Wis., has been incorporated with a capital stock of $500. The promotors are R. E. Doern, M. Moersch, J. Wettscin, W. E Minehan, M. Nichols, A. Langenfeld, Charles Bergen, Jr., Christopher Pickert and Henry Koenig.

THE RAVENNA HOME TELEPHONE COMPANY, Ravenna, Ohio, has been incorporated with a capital stock of $10,000, for the purpose of operating a telephone exchange in Ravenna. The incorporators are W. H. Butler, A. S. Cole, W. S. Drake, L. P. Seymour, W. W. White and D. F. Stocker.

THE NORTHERN ELECTRIC COMPANY has been incorporated at Lewiston, Me., with a capital stock of $120,000. The officers of the company are George C. Wing, Auburn, president; Herbert I. Goss, Berlin, N. H., treasurer. The directors are Alfred W. Fuller, Daniel J. Daily and George C. Wing.

THE FLUSHING & SOUTH SHORE RAILROAD COMPANY has filed articles of incorporation with the Secretary of State at Albany, N. Y., with a capital stock of $150,000. The purpose of the company is to construct a standard gauge road 15 miles long from Flushing, in Queens County, to a point on the Long Island road between Fenhurst and Woodsburg. The directors of the company are William F. Brown, Edward J. Boyle, William L. C. Allan, George A. Hamilton, William J. Hawson, M. J. Keany and J. Hollis Gibson, of Brooklyn; Louis E. Freeman, of Orange, N. J., and Francis L. White, of Summit, N. J.

THE TELEGRAPH AND TELEPHONE.

COEBURN, VA.—The Big Stone Gap Telephone Company of Virginia proposes to extend its line to this place and to Johnsonville in the near future.

QUINCY, ILL.—The Farmers and Merchants Telephone Company's lines between this city and Barry and Pittsfield, in Pike County, have been thrown open to the public.

PEORIA, ILL.—The Peoria City Council has granted the Fulton County Telephone Company a twenty-five-year franchise. The company will give the city the free use of the wires.

NEWARK, N. Y.—Mr. W. H. Kelley of this place will establish a local telephone system. Over forty subscribers are assured. Mr. Kelley would like to hear from telephone manufacturers and contractors.

GALESBURG, ILL.—The telephone company which was organized in Galesburg about three years ago has been revived, and is preparing to establish a system here. There will likely be a war of rates between the new and the old companies.

KNOXVILLE, TENN.—The People's Telephone & Telegraph Company, of this city, is arranging plans for a new building in which to house its central office and other departments of the business. It is stated that the company also contemplates placing its wires underground in conduits.

ALEXANDRIA, VA.—The Gamewell Fire Alarm Telegraph Company, New York, has made a proposition to the fire wardens of this city to furnish the city an electric fire-alarm system, with fifteen boxes and all appurtenances, for $3000. Additional boxes will be furnished at a cost of from $100 to $125.

SAGINAW, MICH.—The Valley Telephone Company has closed a contract with the American Electric Telephone Company, of Chicago, for a portion of its apparatus. The contract will aggregate about $25,000. A submarine cable 1350 feet long has been laid by the Valley Telephone Company across the river to Bay City.

ST. JOSEPH, MO.—The Missouri & Kansas Telephone Company will extend its lines west from Hiawatha in the near future and connect this city with a number of towns in eastern and central Kansas. Work has begun on the new line to St. Louis, and on an extension in southeastern Kansas, taking in such towns as Wichita and Emporia.

LAPEER, MICH.—The new State Telephone Company has been granted a thirty-year franchise in this city on condition that the city be given the use of two telephones free for five years. The Bell instruments, it is stated, will be thrown out. Work on the plant will be commenced at once. The Moore Telephone Company also asked for a franchise, but the application was referred to the city attorney.

KANSAS CITY, MO.—The upper house of the City Council has passed an ordinance providing for a new telephone system for the fire engine houses and the chiefs' residences. It provides that the Missouri & Kansas Telephone Company, whose system will be adopted, shall receive the rental which it is to pay for its underground conduits, until the amount reaches $4000. The rentals from the underground conduits of the company amount to $1500 a year. The new system will connect with the police alarm system.

COLUMBUS, OHIO.—At the passenger station of the Ohio Central Railroad in this city an indicator is placed in a case in the main waiting room for the purpose of indicating to waiting passengers the time at which their train will arrive. It is operated from the train dispatcher's office by electricity. The dials show whether the train is on time and how late it is, in case it is behind time, while a drum, with the name of each of the trains placed on it, is turned by electricity to show which is the next train due.

HENDERSON, KY.—The consolidation of the Great Southern and the Cumberland Telephone companies has been formally ratified at Hopkinsville. The headquarters of the combined companies will be at Hopkinsville. This deal unites two telephone concerns, with a capital stock aggregating $3,500,000. The terms of the consolidation are that the stockholders of the Great Southern get one share of Cumberland stock in exchange for two shares of Great Southern stock, upon which they are to receive dividends for one year.

DALLAS, TEX.—The Southwestern Telegraph & Telephone Company will erect a new building in this city on a plot of ground purchased some six months ago. The new building will be 75 feet square and two stories in height. It will be fireproof. The exchange will be located on the second story, and will be one of the finest in the State. The company has nearly 1000 subscribers in this city, and it is said that the number is increasing at the rate of twenty-five per month. The switchboard being built for the new station will have a capacity of 3000 subscribers.

BOSTON, MASS.—The American Bell Telephone Company publishes each month a statement of telephones outstanding. In this connection it is not generally known that the number given at these times means something different to what is generally understood. For instance, in the last monthly statement, it was shown that the company had outstanding 951,180 telephones, but this number really represents 475,590 complete telephones, according to the Bell Company's method of reporting. It is the company's practice to count one complete telephone as two instruments, the receiver being regarded as one instrument and the transmitter as one; therefore, the statement that the company has 951,180 instruments outstanding means that just half that number are in actual use. This, of course, does not take into account the thousands of independent telephone instruments throughout the country.

ELECTRIC LIGHT AND POWER.

DEPOSIT, N. Y.—At the recent charter election held in this village, the electric light question was voted down by one majority.

BURLINGTON, VT.—There is a movement on foot to utilize the water power of Bolton Falls for an electric plant for Waterbury and vicinity.

MORRIS, ILL.—The city electric light plant is to be enlarged at once. The improvements include two new dynamos, an additional engine and another building.

MACON, GA.—Fitzgerald held an election last week and the electric light question was carried almost unanimously, there being only seven negative votes in the entire city.

WILLIAMSPORT, MD.—The question as to whether the town should issue bonds for electric lights and water works was carried in the affirmative at the recent municipal election.

GREEN BAY, WIS.—A thirty-five-year franchise has been granted to Mr. Allen Shewman by the City Council of this city, to establish an arc lighting system to be operated by De Pere water power.

NEW YORK CITY.—The new electric road, to be known as the Saratoga Northern, will operate between Saratoga Springs and South Glens Falls, with branches to Glens Falls, Sandy Hill, Fort Edward and other intermediate points.

PITTSBURG, PA.—The Westinghouse Electric Company, of this city, has been asked to furnish an estimate and plan for the electric light plant the city of Hagerstown, Md., has just voted $60,000 to erect and control as city property.

ELKHART, IND.—The electric light plant here is to be remodelled. Eighty new transformers are to be added. A new street arc machine will be placed in position at once. A 16,000 incandescent machine and 100 new arc lights have just arrived.

SIOUX CITY, IA.—If the city accepts the proposition just made by the Sioux City Electric Company it is not likely the city will build any electric light plant of its own or vote upon that proposition at the coming election. The new proposition will save the town from $5000 to $6000 annually.

BALTIMORE, MD.—The rates on arc lights in this city have been reduced 33 1-3 per cent. as the result of a war between the electric companies. The rival companies charge each other with cutting the rates first. The Brush and

Edison Companies are on one side and the Northern, formerly the United States, is on the other.

SAN FRANCISCO, CAL.—Prince Poniatowsky is at the head of a company which proposes to bring to this city at least 10,000 horse-power from the waters now running to waste in the Sierra Nevada Mountains, by means of an electrical line 110 miles long. The cost of the plant will be $1,000,000. Prominent electricians and capitalists are interested in the project.

FAYETTVILLE, ARK.—Messrs. A. L. Dyke and T. W. Tarrant, of Galveston, Tex., have purchased the Fayettville electric light and power plant. It is valued at $10,000. Mr. Dyke has been in business in Galveston as an electrical engineer and contractor. His headquarters will now be in Fayettville, where he will continue the same line of business.

PHILADELPHIA, PA.—The Messrs. Du Pont, the powder manufacturers, have informed the authorities of Pennsgrove that if they will extend the borough lines to embrace the powder works at Carney Point, they will give the borough an electric light plant and a trolley to Carney Point, 2 miles distant. The Du Ponts will bear all the expense of both.

McKEESPORT, PA.—The McKeesport Electric Light Company has purchased the plant of the Duquesne Heat, Light & Power Company, paying therefor $25,000. The current for lighting McKeesport and Duquesne will be furnished from this station, and power will be furnished from the same station to the McKeesport, Duquesne & Wilmington Railway Company. The capacity of the McKeesport plant has been increased.

The Electric Railway.

NEW YORK CITY.—The Third Avenue company is to enlarge and improve its power house at Kingsbridge.

PITTSBURG, PA.—Application has been made by the Akron (Ohio) Street Railway Company to extend its line to Barberton.

NEWBURYPORT, MASS.—The Portsmouth & Dover (N. H.) Railroad Company has voted to equip its line with electric power at once.

SCRANTON, PA.—An electric railroad is to be built between Tunkhannock and Lanesboro. The route was surveyed several years ago and found feasible.

DOYLESTOWN, PA.—The stockholders of the Bucks County Railway Company have leased the road to the Doylestown & Willow Grove Traction Company.

BROOKLYN, N. Y.—The Long Island Electric Railway Company has resolved to extend the road to Freeport from Jamaica, and ultimately to Hempstead.

GENEVA, OHIO.—The Cleveland, Painesville and Eastern Electric Railway will extend the line this season to Perry, Madison, Unionville, Geneva and Ashtabula.

BALTIMORE, MD.—A bill has been introduced in the Legislature to incorporate the Princess Anne & Deal's Island Electric Railway Company, the line to be 20 miles long.

PITTSTON, PA.—The Shamokin Street Railway Company, which was not granted all the concessions asked for, has given notice it will not operate the road at all; the tracks will be torn up and the charter surrendered.

NEW YORK CITY.—Residents of Canarsie and Flatlands have petitioned the Brooklyn Heights Railroad Company to extend its Reid Avenue line to Canarsie, through Remsen Avenue. The company already has the charter.

PAWTUCKET, R. I.—The directors of the Tiverton & Fall River Railroad and the Middletown & Portsmouth Railroad, at separate meetings, voted to consolidate. The new company will be known as the Newport & Fall River Railroad.

BENNINGTON, VT.—The proposed electric road from Brattleboro to Hinsdale and Northfield will likely be built the coming season. Hinsdale people are not enthusiastic, as they think it would help Brattleboro at Hinsdale's expense.

POTTSVILLE.—Contractor Thomas H. Connell has secured the contract for building a branch of the Delaware Electric Railway from Milford to Woodland Beach. The line is 34 miles long. It will cost $400,000, and must be completed by July 1.

ST. JOSEPH, MICH.—A syndicate of capitalists, headed by two New York gentlemen, has applied for a franchise for an electric railway to enter Benton Harbor. The line will run east to Sister Lakes, Dowagiac and Kalamazoo, and will be completed about July 1 next.

MILFORD, MASS.—The proposed act incorporating the new Worcester, Milford, Franklin & Attleboro street railway allows three years in which to build some part of the system. The line as proposed will be 43 miles long, the longest single road in New England.

DETROIT, MICH.—A new electric railroad is to be built from Detroit, Mich., to Toledo, Ohio. Work on it has already begun, and it is expected to be finished not later than September 1. The road will cost about half a million. John C. Shaffer, of Chicago, is the promoter.

WOONSOCKET, R. I.—The Legislature has passed the law incorporating the Cumberland Railway Company. The capitalization is not to exceed $100,000, and part of the road must be in operation before July 1. The road will be the connecting link between Woonsocket, Pawtucket and Providence.

WAVERLY, N. Y.—A trolley line is projected from Athens to Towanda, Pa. There is already a line from this place to Athens, via South Waverly and Sayre. The Lehigh Valley Railroad has already withdrawn some of its trains because of the successful competition of this parallel trolley line.

WOONSOCKET, R. I.—The new Worcester, Oxford & Webster trolley company has organized and is ready to seek franchises from those towns. There will be but one grade crossing of the New England road, that at Auburn, and that will probably be eliminated before the company is ready to build.

NEW YORK CITY.—An injunction has been issued preventing the Coney Island & Brooklyn Railroad from increasing its capital stock from $1,000,000 to $2,000,000. This litigation will have the effect of postponing the proposed consolidation of the Coney Island and the DeKalb Avenue roads, and may block it altogether.

PHILADELPHIA, PA.—President Blum and Secretary Benson, of the Hestonville, Mantua & Fairmount Passenger Railway Company, resigned Tuesday. The Board of Directors then elected General Manager Parson, of the Union Traction Company, president, and D. C. Golden, secretary. This change has been expected since the Union Traction Company began to operate the road.

ALBANY, N. Y.—A bill introduced in the Assembly by Mr. Eldridge provides that the Board of Railroad Commissioners may, whenever in their judgment the public safety requires the erection of interlocking switch and signal devices at points where steam and street railways intersect at grade, direct the erection of such devices and apportion the expense thereof between the companies affected thereby.

PHILADELPHIA, PA.—Surveys have been made for a 4-mile extension to the Shamokin & Mount Carmel Electric Railway's system. It will be constructed this summer, and will extend from Mount Carmel to Locust Gap and thence to Locust Dale. At the last-named place it will connect with the line of the Schuylkill Traction Company, thus affording a continuous trolley line from Shamokin to Shenandoah and Mahanoy City.

CHICAGO, ILL.—A trolley line from Chicago to La Porte, Ind., is a possibility in the near future. The Valparaiso, Flint Lake & Chicago Electric Railway has a franchise granted at Valparaiso. The company, which has a capital stock of $50,0000, will build a line to connect with Hobart, Whiting, East Chicago and Hammond. When the line to Valparaiso is completed, an extension will be built to Porter, Chesterton, Michigan City and La Porte. Eastern capitalists are backing the project.

NEWARK, N. J.—Announcement has been made by circular from Philadelphia to the stockholders of the Consolidated Traction Company of New Jersey that a vote will be taken at the annual meeting, March 28, on the proposition to lease the property and franchises of the company to the North Jersey Traction Company. The Consolidated Traction has a capital of $15,000,000. The North Jersey Traction will absorb by lease or merger all the independent trolley lines between Newark and the Oranges and Paterson.

WAUPACA, WIS.—The Common Council of this city and the Town Board of the town of Farmington have granted Irving P. Lord and W. B. Baker a franchise to build and operate an electric street railway from the Wisconsin Central Railroad depot in Waupaca to the Chain o' Lakes, a distance of 5 miles. The new line will be operated on a summer schedule, and will reach the Wisconsin Veterans' Home and the Grand View Hotel resort. Mr. Lord is the president and Mr. Baker the secretary of the Waupaca Electric Light Association, and it is the intention of these gentlemen to commence work upon the new road the early part of April. The Waupaca Electric Light Association's plant is operated by water power, and as there is an abundance of water going to waste, it will be utilized in furnishing power for the new railway.

Personal Notes.

MR. LOUIS W. MILLER, superintendent of police telegraph, Rochester, N. Y., was in New York City last week.

MR. J. T. WHITLESEY has resigned the position of chief engineer of the Brooklyn Heights Railroad to accept one with the John Stephenson Company, New York, the well-known builder of street cars.

MR. F. D. LESLIE, manager of the Institute for Home Study of Engineering, Cleveland, Ohio, was in New York on business last week. Since the consolidation of the institute with the Correspondence School of Technology the scope of the school has been considerably broadened.

MR. JOHN C. BRACKENRIDGE has been appointed chief engineer of the entire system of the Brooklyn Heights Railroad, Brooklyn, New York, vice Mr. J. T. Whitlesey, resigned. Mr. Brackenridge has been connected with the company for the past four years as engineer of the track department.

MR. HENRY FLOY has done such good work for the Westinghouse Electric & Manufacturing Company in Chicago that he has been promoted by being transferred to Minneapolis to look after the business of the company in the Northwest. Mr. Floy is one of the best-known engineers of the Westinghouse Company, and for many years was in the company's works at Pittsburg.

MR. C. C. WARREN, president of the Warren Electric Manufacturing Company, Sandusky, Ohio, is in the East on a trip combining business and pleasure. He visited New York last week and renewed a number of old acquaintances. Mr. Warren is an old timer in the electrical business, having been identified in Chicago and New York with the old United States Company, and afterward with the Edison Company. He is now in business for himself at Sandusky, and his company has so many orders ahead that he is able to get off for a brief vacation.

Trade and Industrial Notes.

THE ERIE ENGINE WORKS, Erie, Pa., proposes to enter the electrical field and solicit orders for engines for electric light and power work.

FRICTION AND LUBRICATION is the title of an eight-page pamphlet issued by the Joseph Dixon Crucible Company, Jersey City, N. J. It gives considerable information on these two important subjects.

MR. W. MAHANEY, until recently with the Graphite Rheostat Company, of Chicago, is now connected with the electrical department of George I. Roberts & Brother, Inc., 471 and 473 Fourth Avenue, New York.

THE WALKER COMPANY has just issued two circulars, Nos. 1067 and 1068. The former relates to electric locomotives and the latter to boosters.

Both circulars are illustrated with detail diagrams and half-tone views of the subjects under consideration.

DIXON'S BELT DRESSING and Leather Preservative, made by the Joseph Dixon Crucible Company, Jersey City, N. J., is said to be a thoroughly reliable belt dressing. Those who use it claim that it prevents slipping and preserves the life and elasticity of the belt.

THE DAVIS & EGAN MACHINE TOOL COMPANY, Cincinnati, Ohio, has just received an order from Amsterdam for several of its machines to be used by the Holland Government. Several other machines have been ordered from London to go to Leeds, England. The company's home business is improving.

THE UNION MALLEABLE IRON, GRAY IRON & STEEL WORKS, Philadelphia, Pa., is in a position to make prompt shipments of castings. It has been compelled to run its castings department double turn to meet the growing demand for its steel castings and other products. Messrs. Stanley G. Flagg & Co. are proprietors of the works.

MR. CHARLES S. BARKELEW, Middletown, Ohio, is doing a large business in dynamo brushes. He pays especial attention to supplying central stations, and states that he has among his exclusive customers several of the largest stations in the world. Although his factory has a large capacity he finds it difficult to supply the demand for his brushes.

THE MICHIGAN PIPE COMPANY, Bay City, Mich., is working on an order for 14,685 creosoted tamarack cross ties for the Denver Consolidated Tramway Company, Denver, Col. This same company purchased 1600 creosoted ties from the Michigan Pipe Company last year, and after investigating their merits placed this large order for the 1898 improvements.

THE ERICSSON TELEPHONE COMPANY will on or about April 1 move from 10 Warren Street to 20 Warren Street, New York, where it will have a much larger space, on the ground floor. This change is necessitated by the constantly growing demand for the company's telephones. A new catalogue will be issued about the time of removal, and a copy will be sent to any address on application.

THE SARGENT COMPANY, Chicago, Ill., states that owing to the increase in its business it is compelled to enlarge its producing facilities, and to that end has recently installed a 20-ton electric traveling crane and other machinery. In the power house new engines, dynamos, etc., are about to be installed. The company now has a capacity of about 1000 tons a month, which will be greatly increased by the changes now in progress.

THE McCAY-HOWARD ENGINEERING COMPANY, 106 East German Street, Baltimore, Md., has changed the style of its corporate name to McCay Engineering Company. This company is working on Government contracts as follows: For the new post office, Washington, D. C., 150-kw generators directed connected to Buckeye engines; plant for mortar battery, Fort Monroe, Va., consisting of Priestman engine and Lundell dynamo in connection with stationary and portable storage battery, and a mortar battery for Great Gull Island.

THE ATLANTA CHAMBER OF COMMERCE and the City Council recently issued a hand book giving an historical account of Atlanta. The commercial, industrial and residential interests are described, and the book is handsomely illustrated, over 100 half-tone engravings being incorporated in its pages. The telephone, street railway and electric light interests are included in the descriptive matter. A copy of the book may be obtained on application to Mr. V. V. Bullock, secretary of the Atlanta Chamber of Commerce.

THE E. W. BLISS COMPANY, Brooklyn, N. Y., reports an unusually large demand for presses, dies, etc., especially those which are adapted for electrical work. For this purpose the company manufactures a large line of tools for blanking and notching armature discs and sections, as well as for producing other parts of electrical machines. Included in this list is a very large number of double-crank presses, which range from the smallest to the largest sizes. In connection with electrical work, the Bliss Company calls special attention to its improved automatic armature disc-notching press for discs of all diameters.

THE PERU ELECTRIC MANUFACTURING COMPANY, Peru, Ind., has one of the largest and most complete plants in the country for the manufacture of porcelain insulators. It was organized in 1892, since which time the business has rapidly grown and the original plant has been added to several times. The company is now preparing for the erection of another building. It will be 25 feet wide and 75 feet long, and built of brick, with an iron or slate roof. It will contain the clay bins, which are now located in other buildings. The second story of the new building will contain all the dies used in the company's business.

WE HAVE RECEIVED from the Fort Wayne Electrical Corporation, Fort Wayne, Ind., a copy of its complete catalogue of the "Wood" system of electrical machinery and apparatus for light and power. It is very attractively gotten up, every type of machine and class of apparatus being represented in pictorial form. The catalogue is divided into three sections, the first part being devoted to arc lighting apparatus, the second to alternating current apparatus and the third to direct current apparatus. The illustrations are artistically executed, and show very clearly the principal features of the various machines and devices manufactured by this company.

THE WESTERN ELECTRIC COMPANY, Chicago and New York, has issued a handsome thirty-six-page illustrated fan motor catalogue, printed in two colors. It calls attention to direct current ceiling fans, and desk and ceiling fans of the alternating current type. A detailed sectional drawing of the direct current ceiling fan is given together with a comprehensive description of the same. Column fans are also described and illustrated. The Tuerk alternating current ceiling fan is described and illustrated by a sectional drawing. All in all this catalogue is one of the most complete of its kind ever issued. It is substantially bound in a neat and artistic cover.

THE ELECTRIC LIGHT PLANT now being installed in the new building of the Peruna Drug Manufacturing Company, Columbus, Ohio, includes two Ball engines of 160 horse-power, built by the Ball Engine Company, Erie, Pa., and direct connected to Siemens & Halske dynamos. The electric light plant on the steamer "City of Erie," which is now being built at Detroit for the Cleveland & Buffalo Transit Company, consists of Ball engines directly coupled to dynamo machines, built by the well-known firm, the Fuller Company, Detroit, Mich. A 450-hp Ball engine is being installed by the Shenango Valley Steel Company at New Castle, Pa. It is belted to Westinghouse generators, the power from which is used for the operation of electric cranes, electric lighting, etc.

ALTERNATING CURRENT STATIONS very often have no day circuit and consequently have not thought it worth while to investigate the possibilities for revenue in the introduction of fan motors, yet it is on the hot and sultry evenings that the drug store, the soda-water fountain and the ice cream parlor do their most thriving business. A ceiling fan motor, in addition to being an ornament, will not only keep the rooms free from flies and insects of all description, but will give a cooling breeze to the patrons of the places using them. The Western Electric Company, Chicago, is agent in the West for the Tuerk alternating current ceiling fan. This fan has been on the market for several years, and has proved to be a satisfactory device both mechanically and electrically. All central station men who are wide awake and looking around for means of increasing the revenue of their stations should investigate its merits.

WATER WHEEL CONTRACTS.—Among the recent contracts of the Pelton Water Wheel Company, San Francisco, are the following: A 150-hp wheel for needle factory in Japan; a 600-hp wheel for a tea and quinine plantation in Java; a 50-hp wheel for a coffee plantation in Nicaragua; a 4-foot wheel for the Jumper Mine, Cal., directly connected with a 250-hp Westinghouse generator, to operate electric air compressing plant; a 75-hp wheel for a mining plant near Juneau, Alaska; six wheels for driving generators and other machinery at the Red Boy Mine; an 18-foot wheel directly connected with air compressor for the Hilo Electric Light Company, Hawaiian Islands; a wheel for the Salt Lake & Ogden Street Railway Company, to drive a 60-kw generator under a head of 230 feet of water; three wheels, each 19 feet 6 inches in diameter, directly connected to jack-shafts in the new 340-stamp mill of the Alaska Treadwell Mine Company, of Douglas Island, Alaska. One of the wheels will drive 300 stamps. This system of direct connection is an innovation in the practice of the mining company.

AN INTERESTING TEST of the Cochrane steam separator was made at one of the stations of the Edison Electric Illuminating Company, of Boston. Owing to the difficulties of obtaining a fair sample of the steam on the boiler side of the separator, as the water in the steam was apparently unequally distributed over the cross section of the pipe, on account of the effect of gravity, the calculations were made by comparing the amount of entrained water entering the separator with the amount of moisture shown by the calorimeter attached to the short sections between the separator and the main engine valve. The calorimeter at this point showed that the steam continued .06 per cent. of moisture, and careful measurements in a volumetric tank corrected for temperature showed that there was discharged from the separator 18 pounds of water per hour, the total steam and entrained water passing through the engine, as shown by the discharge from the surface condenser, being 7359 pounds per hour. Hence the steam entering the separator contained .78 per cent. of moisture, of which all but .06 per cent. was separated out. In other words, the separator took out about 92 per cent. of the water entrained in the steam entering it.

THE MERITS OF THE PLASTIC BOND for electric railways are well brought out in a recent letter to Mr. Harold P. Brown, New York, from Mr. R. D. Apperson, general manager of the City Street Car Company, Staunton, Va. Mr. Apperson says: "A few days ago a representative of one of the largest wire bond makers was here in the interest of their bond, and the question came up regarding the permanency of your cork type plastic bond. I made the assertion that I was satisfied the ones on our road were in as good condition as on the day they were placed in the track, over two years ago. We went over the road and selected a joint in a very low place where water and mud stands almost continually. We removed the plates and found the bonds were in perfect condition; the contacts were bright and as perfect as if they had just been placed. This bond had never been tested nor inspected since the day it was installed two years before. I send herewith a photo of a bond taken from the same place, which speaks for itself. In placing a new switch in our tracks in January, 1897, we removed several rails that had been bonded with your cork type plastic bond the year before. These rails were hauled to the station, and piled in the yard. Several days ago we had occasion to use this rail and found the cork receptacles were still on the rail and in good condition. To my surprise the contacts, which had been amalgamated in March, 1896, were still perfect; all that was necessary was to rub off the dirt with the finger. This I think remarkable, as the rails had been exposed to all kinds of weather in the scrap pile for over a year, and is very gratifying to me, as I trust it will be to you, since it shows just what the amalgamation will stand. The condition of the bonds that are now in the track which I have inspected look as if they would last for years to come."

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

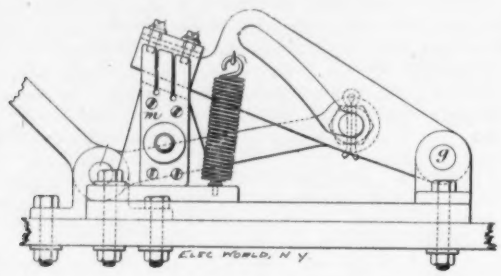
REDUCED FREIGHT RATES FOR SETTLERS.—In order to encourage the movement of settlers and land buyers from Illinois, Wisconsin, Iowa and the Eastern States to Western Minnesota, South Dakota and North Dakota, the Chicago, Milwaukee & St. Paul Railway Company has very materially reduced its carload rates for emigrant movables, so that farmers who have purchased lands in Western Minnesota, South Dakota and North Dakota can take all of their belongings with them to their new homes at small expense, which inducement upon the part of the Chicago, Milwaukee & St. Paul Railway will no doubt be greatly appreciated by those who are thus benefited. For further information apply to any representative of the Chicago, Milwaukee & St. Paul Railway, or address J. H. Hiland, General Freight Agent, Old Colony Building, Chicago, Ill.

Illustrated Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 15, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

600,509. CONTROLLER FOR ELECTRICALLY PROPELLED VEHICLES; R. T. D. Brougham and W. C. Bersey, London, England. App.



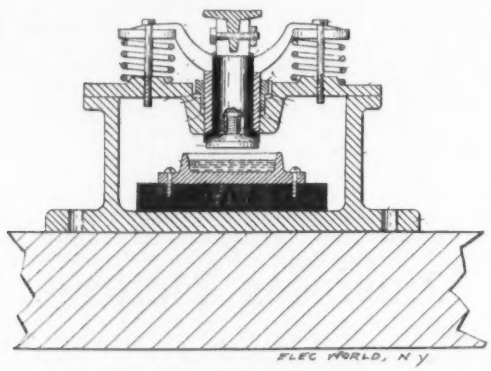
No. 600,509.—Controller for Electrically Propelled Vehicles.

filed Dec. 13, 1897. The combination of a switch lever, a brake lever, a foot lever, a connection between the foot and switch levers, such that the first movement of the former causes a rapid and wide separation of the contacts, and a connection between the foot lever and brake lever, such that the movement of the former gradually operates the latter.

600,523. QUICK-BREAK ELECTRIC SWITCH; T. E. Drohan, Chicago, Ill. App. filed Nov. 13, 1897. The combination in an electric switch, with a pivotally mounted conducting blade, of a secondary blade similarly mounted, a spring associated with said secondary blade, circuit terminals between which the said blades are adapted to complete an electrical circuit when the switch is closed, an eccentric part carried upon and moving with actuate the secondary blade and secure its withdrawal from circuit terminal, whereby the spring is permitted to act and suddenly open the circuit. actuate the secondary blade and secure its withdrawal from circuit terminal, whereby the spring is permitted to act and suddenly open the circuit.

600,527. DEPRESSIBLE RAIL SYSTEM FOR ELECTRIC RAILWAYS; William Grunow, Jr., Bridgeport, Cann. App. filed April 12, 1897. An electrical contact system, consisting of contact receptacles having a tubular projection formed in the cover thereof, and being provided with a mercury receiver, connections between the receiver and source of elctrical supply, a sleeve movably mounted in said tubular projection and having outwardly directed arms, means for supporting said arms, a contact device carried by said sleeve and a depressible rail connected with the contact device and adapted to be charged when depressed.

600,564. PROTECTIVE APPLIANCE FOR ELECTRIC RAILWAYS; L. E. Walkins, Springfield, Mass. App. filed July 17, 1897. In an electric railway, the combination with the "third-rail" conductor and a support and bed for said rail constructed to partially inclose the rail and having the upper surface thereof inclining from near the tread portion of the rail outwardly and downwardly at each side thereof, of separated supports rising above the bed at intervals along, at either side of the rail, and the



No. 600,527.—Depressible Rail System for Electric Railways.

guard rails sustained in separation and parallelism above the rail top on said supports.

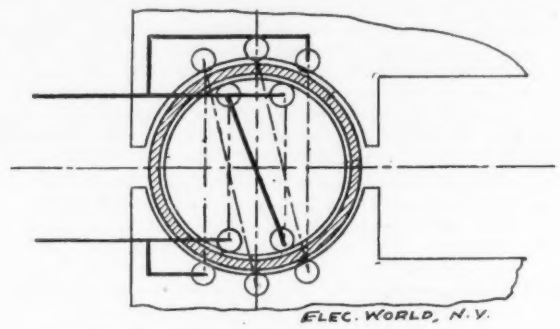
600,593. CUT-OUT; A. R. McNeill, Oldfields, W. Va. App. filed Oct. 7, 1897. In a cut-out, the combination of an interrupted main line; a support; a single pair of contacts for the terminals of the main line carried by said support; a short line carried by an arm and normally out of contact with the main line; a local line carried by a second arm, also normally out of circuit with the main line; and means for moving either arm and bringing either of the lines into circuit with the main line terminals.

600,607. INSULATOR SUPPORT FOR ELECTRICAL CONDUCTORS; F. Genedict, Niles, Mich. App. filed Sept. 13, 1897. In an insulator support, in combination with an arm for suspending an electrical conductor, a strap to embrace the support and means for clamping the strap thereto, a bolt carried by the strap and an insulator carried by the bolt.

600,616. ALTERNATING CURRENT METER; G. Hummel, Munich, Germany. App. filed Oct. 30, 1897. In an alternating current meter of the motor type, the combination of an auxiliary wound electromagnetic core of general U or horseshoe shape, combined with main winding laid in grooves or holes in the said electromagnetic core, means whereby the proper phase-displacements may be obtained, and a moving part under the influence of the electromagnetic core for indicating the passage of current through the windings.

600,633. TROLLEY; J. Clayton, Cuyahoga Falls, Ohio. App. filed Nov. 4, 1896. The combination with head sections adapted for connection to the trolley pole, of hollow bearing sections connected to said head sections and adapted to contain the lubricant and extending inwardly and having their inner edges meeting, each bearing section being provided with a lubricating opening, and a trolley wheel mounted to turn on said bearing sections.

600,693. METHOD OF MAKING SOLUBLE METAL ELECTRODES FOR ACCUMULATORS; Jules Julien, Brussels, Belgium. App. filed Sept. 26, 1896. The process of producing a soluble electrode for use in secondary batteries, consisting in depositing on a copper plate, by electrolysis, a finely porous surface of pure copper, then amalgamating the



No. 600,616.—Alternating Current Meter.

copper surface so produced, and finally depositing on the amalgamated surface a coating of zinc to form the active surface of the electrode.

600,719. GALVANIC BATTERY; E. Habermann, Michigan City, Ind. App. filed Oct. 7, 1897. In an electric battery, the combination with superposed battery elements, of a wick disposed between and in contact with both elements, and an exciting fluid isolated from the elements and in which a portion of the wick is immersed.

600,743. AUTOMATIC SAFETY CIRCUIT CLOSER AND CUT-OUT; W. L. Pratt, Adams, N. Y. App. filed May 13, 1896. In an automatic cut-out, comprising hinged arms, carrying loop connections, said arms being held normally in circuit by a fuse wire, a plate through which the current passes, and which acts as a magnet, a pivoted armature mounted upon said plate, and a needle or pointer also pivoted upon the plate co-operating with the fuse wire.

600,765. AUTOMATIC FIRE-ALARM; R. J. Baker, Baltimore, Md. App. filed April 28, 1897. The combination with a door and a casing provided with a catch, of an angular bracket having slotted arms in contact with the door, screws through the slots for adjustably securing the bracket to the door, magnet coils mounted on the upright arms of the bracket, a bracket secured to the door, provided with openings through which the coils pass and smaller side openings, the armature, pins projecting back therefrom through the side opening of bracket, and springs around the pins, bearing against the armature and the bracket to hold the armature normally in engagement with the catch.

600,850. PRIMARY BATTERY; J. E. Fuller, New York, N. Y. App. filed April 5, 1897. In a primary battery, a casjng provided with vertical partitions and transverse partition plates, whereby separate cells and storage compartments are formed, said cells being closed at one end by said partition plates, and at the other end by cap plates to which depending, tubular positive poles are secured, and which are removable therewith, said cap plates being also provided with central openings through which the zincs are passed, and said partition plates being also provided with ports or passages whereby the battery fluid may be passed from the cells to the compartments and from the compartments back to the cells, and means for closing or opening said ports or passages, consisting of shafts which pass through the bottoms of said compartments.